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Vol 7, pt 1

FAO Fisheries Synopsis No. 125, Volume 7, Part 1

FIR/S125 Vol. 7, Part 1

FAO SPECIES CATALOGUE

VOL. 7. CLUPEOID FISHES OF THE WORLD

(Suborder CLUPEOIDEI)

AN ANNOTATED AND ILLUSTRATED CATALOGUE
OF THE HERRINGS, SARDINES, PILCHARDS, SPRATS, SHADS,
ANCHOVIES AND WOLF-HERRINGS

Part I - Chirocentridae, Clupeidae and Pristigasteridae

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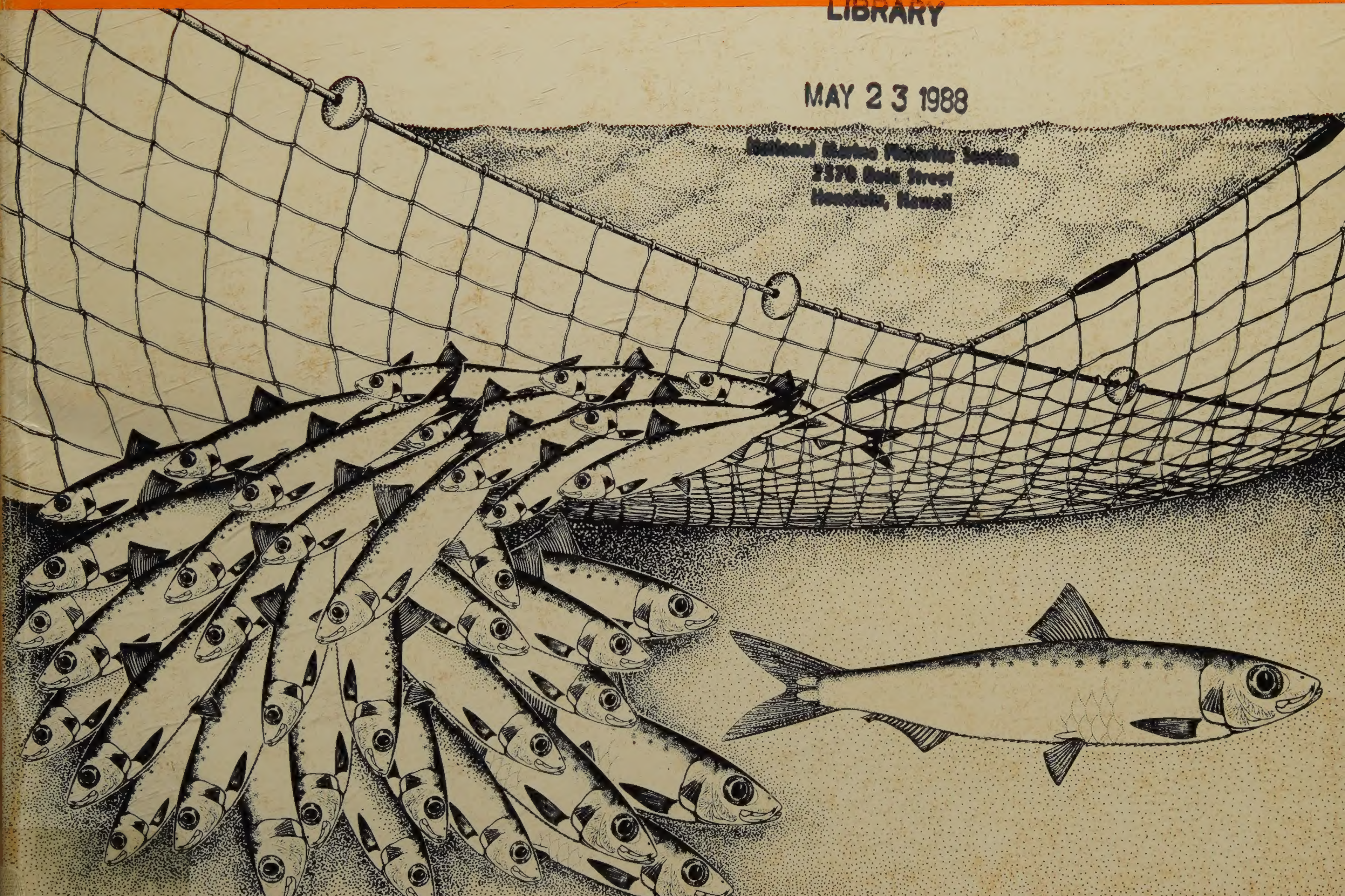

UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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An Annotated and Illustrated Catalogue of the
Herrings, Sardines, Pilchards, Sprats, Shads, Anchovies and Wolf-herrings

Part 1 - Chirocentridae, Clupeidae and Pristigasteridae

prepared by

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UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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PREPARATION OF THIS DOCUMENT

The present publication was prepared under the FAO Regular Programme, with the support of the United Nations Development Programme, as part of the UNDP/FAO Global Project on Survey and Identification of the World's Marine Fishery Resources (GLO/82/001). It is the seventh worldwide species catalogue in the FAO Fisheries Synopses series.

The author is the foremost specialist in clupeoid taxonomy and has also had considerable experience in the field, especially with regard to clupeoid fisheries in tropical and subtropical areas. He has provided the clupeoid families for the FAO identification sheets for all the areas so far published (except the Mediterranean, Fishing Area 37).

All illustrations signed TW were kindly provided by Dr Thosaporn Wongratana (Chulalongkorn University, Bangkok); the remainder were redrawn (and modified) at FAO from the literature or from the author's sketches, under the supervision of the author and the editor.

The index of scientific and vernacular names was prepared in collaboration with FAO's Fishery Information, Data and Statistics Service.

In producing these catalogues and other taxonomic works within the Global Project, FAO is very much aware that the participation of specialists depends not only on their willing cooperation, but also on the moral and other support that they themselves receive for such work from their own institutions. In the present case the support of the British Museum (Natural History) is gratefully acknowledged.

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ABSTRACT

This is the seventh in the FAO series of worldwide illustrated catalogues (synopses) of major groups of organisms that enter marine fisheries. The present catalogue includes all clupeoid fishes (suborder CLUPEOIDEI - herrings, sardines, pilchards, sprats, shads, anchovies and wolf-herrings), comprising 4 families, 80 genera and over 300 species, contributing to more than a quarter of the world fish catch. Keys are given to the families, subfamilies and genera, with a glossary of technical terms and measurements, and a review of major literature sources within each FAO fishing area. Genera and species are diagnosed, with drawings, scientific and vernacular names, information on habitat, biology, fisheries, and distribution (with map); reference is also made to subspecies and to any taxonomic or other problems. The occurrence of the species within the FAO fishing areas is tabulated. All scientific names applied to clupeoid species are given in the synonymies, and these as well as the vernacular names are indexed; there is also a complete bibliography of all literature cited.

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1. INTRODUCTION

This catalogue includes taxonomic references to all the known species of clupeoid fishes (four families, 80 genera, more than 300 species), regardless of their importance or not to fisheries. Their classification is shown in Fig. 1. The exact totals are not yet certain, but it is more than a century since Günther attempted in his Catalogue of fishes in the British Museum (Vol. 7, 1868) to list all the valid species; Fowler's Catalog of world fishes (clupeoid part 1973), also tried to list all known clupeoid fishes, but the names and synonymies are nowadays merely confusing. The present attempt is more an expression of the 'state of the art' than a definitive statement, but it may serve to pin-point those areas requiring more taxonomic treatment and it summarizes the many taxonomic and nomenclatural changes that have been made in recent years.

In a group such as the clupeoids, with numerous and often closely similar species, it is inevitable that some true species have long been concealed in the synonymies of others, while very many more names have been proposed than are actually needed. As a result, much of our biological knowledge, except in the case of a few well-known species of mainly the cooler waters, is tied to identifications and names which may not be correct, thus seriously limiting the credibility of many biological studies. There is often little that can be done in retrospect; specimens were not kept and modern diagnostic features were not mentioned in the publication. For this reason, many apparently useful references have been omitted here and the synonymies are often confined to the original proposal of a synonym.

The clupeoid fishes are of prime importance to fisheries. In fact, they represent the largest suborder of non-domesticated vertebrates harvested by man. Half the world catch of fishes comes from about sixty species of various groups, but a third of those prime species are clupeoids. Unfortunately, the compiling of fishery data for clupeoids has been hampered, as with biological studies, by poor identifications and incorrect nomenclature. Under such conditions, rational exploitation of clupeoid resources, especially in tropical and subtropical seas, has often been impossible. Neither is there any guarantee that models derived from the better known cool-water species are applicable to the low latitude fisheries.

Both biological and fisheries studies, therefore, must be underpinned by sound taxonomy. It is hoped that the present catalogue will contribute to this end.

The clupeoid fishes are united in the suborder Clupeoidei of the order Clupeiformes. They include the herrings, sardines, sprats, shads, etc., the wolf-herrings and the anchovies. In general, the herring-like clupeoids (families Clupeidae, Pristigasteridae) are easily recognized by their keel of scutes along the belly, small and often poorly toothed mouths, and silvery appearance. Similarly, the anchovy-like clupeoids (Engraulididae) are usually distinctive because of their projecting, pig-like snout, large mouth and 'underslung' lower jaw. The fang-like teeth of the wolf-herrings (Chirocentridae) are also distinctive. On the whole, fishery workers have little difficulty in picking clupeoids out of the net.

In spite of this clupeoid 'look', however, there are so many exceptions to any of the more obvious and external features used in the past to diagnose the clupeoids that modern diagnoses rely mainly on small internal characters, such as details of the caudal fin skeleton and the characteristic coupling of the swimbladder, inner ear and head canal system. One result of this difficulty is that in the earlier literature the clupeoids were frequently allied with the tenpounders (Elopidae), ladyfishes (Albulidae), milkfishes (Chanidae) and certain other 'lower' (i.e. primitive) bony fishes and relegated to the order Isospondyli. In fact, there was no common ancestry to all these groups and the clupeoids are rather distantly related to the others. For example, the tenpounders and tarpons (Elops, Megalops) and the ladyfishes (Albula) have a ribbon-like, leptocephalus larva, which allies them with the eels. The clupeoids are now placed in the distinct suborder Clupeoidei and, with the suborder Denticipitoidei (sole modern genus Denticeps), comprise the order Clupeiformes. Their relationship to fossil forms and to all other bony fishes is shown in Fig. 2.

Throughout the Catalogue the term clupeoid refers to members of the suborder Clupeoidei; clupeid refers to the family Clupeidae, pristigasterid to the family Pristigasteridae, and engraulid to the family Engraulididae; the subfamily names are similarly treated (clupeine, pellonuline, alosine, etc.).

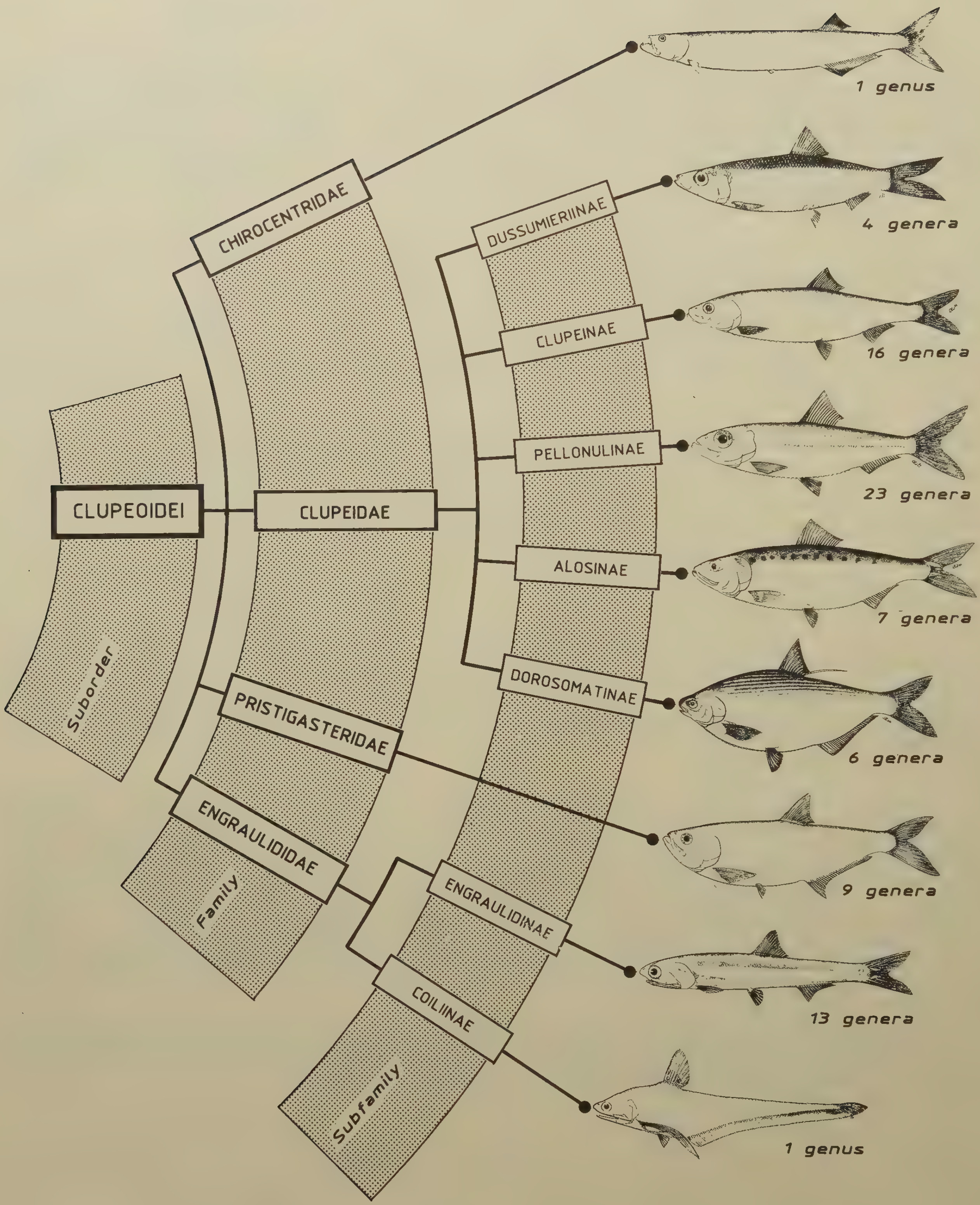

CLUPEOIDEI
Suborder
CHIROCENTRIDAE
CLUPEIDAE
PRISTIGASTERIDAE
ENGRAULIDIDAE
Family
DUSSUMIERIINAE
CLUPEINAE
PELLONULINAE
ALOSINAE
DOROSOMATINAE
ENGRAULIDINAE
COILIINAE
Subfamily
1 genus
4 genera
16 genera
23 genera
7 genera
6 genera
9 genera
13 genera
1 genus

Fig. 1 Classification of clupeoid fishes

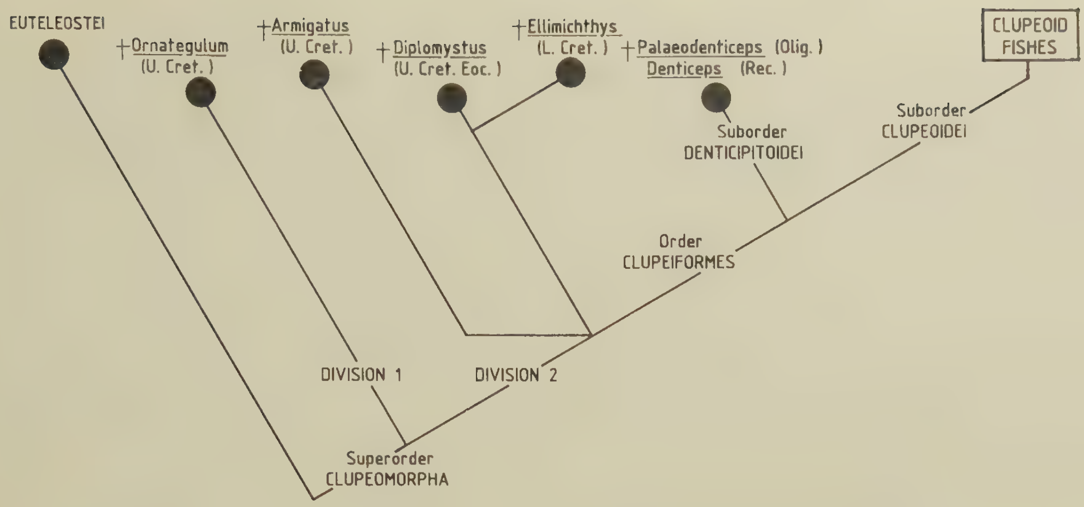

EUTELEOSTEI
†Ornategulum (U. Cret.)
†Armigatus (U. Cret.)
†Diplomystus (U. Cret. Eoc.)
†Ellimichthys (L. Cret.)
†Palaeodenticeps (Olig.)
Denticeps (Rec.)
CLUPEOID FISHES
Suborder DENTICIPITOIDEI
Suborder CLUPEOIDEI
Order CLUPEIFORMES
DIVISION 1
DIVISION 2
Superorder CLUPEOMORPHA

Fig. 2 Relationships of clupeoid-like fishes (fossil forms, from Lower and Upper Cretaceous, Eocene and Oligocene, shown with †)

1.1 Clupeoids in World Fisheries

1.1.1 Clupeoid catches

More clupeoid fishes are caught (by weight, but presumably also by number) than members of any other single systematic group of fishes. The following figures, from the FAO Yearbook of fishery statistics (1982) bear this out.

All marine and freshwater fishes	67 769 371	tons		
Clupeoid fishes	18 897 731	tons	=	17.9%
Cod-like fishes	10 969 042	tons	=	16.2%
Tunas	2 593 212	tons	=	3.8%
Flatfishes	1 126 879	tons	=	1.7%

This huge contribution made by clupeoid fishes to world fisheries can be expressed in other ways. For example, the top 56 fish species (i.e. those harvested at over 100 000 tons in 1982) accounted for 40 004 027 tons or about 60% of the world fish catch. Of these 56 top species, no less than 18 were clupeoids, which contributed 16 693 748 tons or about 24% of the world fish catch. Again, in 1982 there were 24 fish species harvested at over half a million tons. Of these 24 species, 10 were clupeoids, which contributed just over 20% to the total world fish catch. In that year, the second most exploited fish in the world was a clupeoid (Sardinops melanostictus of Japan), as also the third (S. sagax of Peru and Chile) and the seventh, ninth and tenth (Engraulis ringens of Peru and Chile, formerly the most exploited fish in the world; Clupea harengus of the North Atlantic; Sardina pilchardus of the northeast Atlantic and Mediterranean). In fact, the most heavily exploited fish in the whole history of world fishing was the Peruvian anchoveta E. ringens, of which over 13 million tons was landed in 1970.

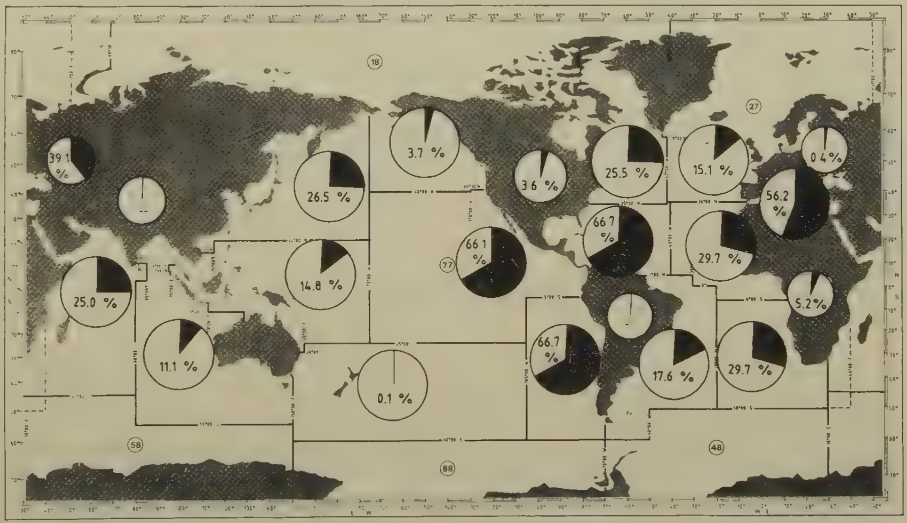

(18)
(27)
(77)
(58)
(88)
(48)
39.1 %
3.7 %
26.5 %
3.6 %
25.5 %
15.1 %
0.4 %
56.2 %
66.7 %
66.1 %
29.7 %
25.0 %
14.8 %
5.2 %
11.1 %
0.1 %
66.7 %
17.6 %
29.7 %

Fig. 3 Clupeoids as a percentage of the total fish catch in each fishing area (1982 figures)

In four of the FAO fishing areas (see Fig. 3), clupeoids account for over half the fish catch and in another six fishing areas they account for over a quarter of the fish catch.

The size of the clupeoid fisheries is the result of two main factors. First, the majority of clupeoids feed close to the base of the food chain and can thus benefit more directly from nutrient-rich areas where there is a seasonal or more continuous bloom of plankton. Second, clupeoids are almost always schooling fishes and thus extremely vulnerable to nets (especially purse seines), which can catch a large volume of fish in a short time. Since it is the cooler high latitude seas and the areas of upwelling that are richest in plankton, it is here that the major clupeoid fisheries exist, as the following figures show (divisions not based on FAO fishing areas; 1982 totals).

All clupeoid species	18 897 731 tons		
Cool or upwelling areas	15 603 531 tons	=	82.6%
Subtropical areas	1 777 278 tons	=	9.4%
Tropical areas	1 516 922 tons	=	8.0%

Not only do the cooler-water clupeoids dominate the total clupeoid catch, but they represent nearly a quarter of the world fish production. The 1982 catch of the Japanese pilchard (Sardinops melanostictus) was alone more than the combined catch of all tropical and subtropical clupeoids, while the catch of the South American pilchard (S. sagax) was almost that amount. In tropical waters, clupeoids are represented by more species, none of which can rival in abundance the cool-water species. The only warm-water clupeoids whose stocks approach those of the cooler waters are members of the Sardinella aurita complex (S. aurita in the eastern and western Central Atlantic, plus S. brasiliensis; S. longiceps in the Indian Ocean; S. lemuru in Indonesia, western Australia and Japan), also the unrelated S. maderensis off West Africa. However, in each area these fishes are associated with at least some upwelling during the year and in at least some part of their natural range.

The predominance of the cool-water clupeoids does not mean that the tropical and subtropical clupeoid fisheries are unimportant. First, they may in some cases be capable of further development by more mechanized exploitation and better processing facilities, whereas the cool-water clupeoid fisheries are usually fully or even over-exploited and are often prone to collapse. Second, the warm-water clupeoid fisheries are frequently a subsistence rather than a cash resource in exactly those areas where other sources of animal protein are inadequate or unused. Certainly, their cash value is low, but so also is their local purchase price, so that their contribution to nutrition in such areas is not to be judged merely by contrasting warm-water with cool-water catches.

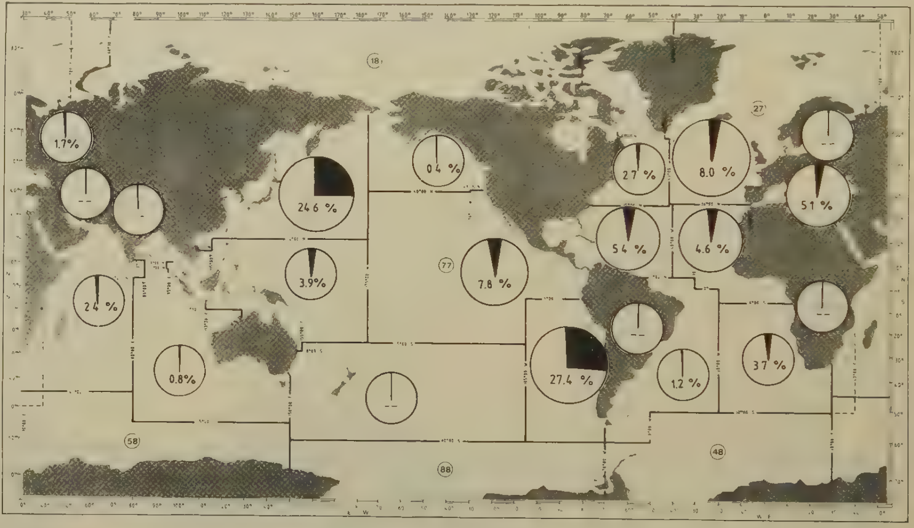


Fig. 4 Clupeoid catches by fishing area as a percentage of the total world catch of clupeoids (1982 figures)

The largest clupeoid catches (see Fig. 4) come from the southeast Pacific (Fishing Area 87; 27.4% of all clupeoid catches), based primarily on the Peruvian pilchard and the Peruvian anchoveta, and also from the northwest Pacific (Fishing Area 61; 24.5% of all clupeoid catches), based primarily on the Japanese pilchard. Next in importance are the northeast Atlantic (Fishing Area 27), the eastern Central Pacific (Fishing Area 77), the Mediterranean and Black Sea (Fishing Area 37) and the western Central Atlantic (Fishing Area 31), each of which catches over a million tons of clupeoids annually. The remaining areas, not all of them tropical, each catches three quarters of a million tons or less. In general terms, the entire Pacific yields about 60% of all clupeoids, the Atlantic about 30% and the Indian Ocean only about 3%.

As in other groups of fishes, the cool-water and upwelling areas support few clupeoid species and the main component of the catch may come from a single species, or perhaps two. Often these are a pilchard (Sardinops) and an anchovy (Engraulis), whose relative abundance may oscillate as a result of a complex ecological relationship between the two (further modified by bird or fish predation and human exploitation). The subtropical and especially the tropical areas, on the other hand, support a great diversity of clupeoids and the fisheries are multispecies. A purse seine or a beach seine may bring in ten or more clupeoid species which have schooled more or less together, but little is known yet of the factors that determine the relative abundance of each species and the effect than one species may have on another. In terms of diversity, the richest area is the Indo-west Pacific (Fishing Areas 51, 57, 71), with about 160 clupeoid species or half the total clupeoid species known, yet it produces only 7% of the world clupeoid catch.

Catches of clupeoids have increased, especially since the second world war, sometimes very much in advance of the general rate of increase in fish production (especially during the boom years of the Peruvian anchoveta fishery in the late sixties and early seventies) (Fig. 5). Dominating the clupeoid increase have been the pilchard (Sardinops) and anchovy (Engraulis) fisheries and not the traditional northern fisheries for herrings (Clupea), nor the tropical clupeoid fisheries. Characteristic, however, of those clupeoid species which dominate the fisheries of particular areas is a tendency to oscillate rather drastically in their abundance (Fig. 6). Although the production of good or bad year-classes (which may vary by a factor of ten or more) can be related to ecological factors, the precise role played by fisheries is still not clear. The considerable fluctuations in catches of Atlanto-Scandian herrings (Clupea harengus), both before the second world war (27 to 108 thousand tons) and after (33 to 78 thousand tons) may merely have reflected fishing effort itself, not intermittent over-exploitation. Nevertheless, with the collapse of this fishery in 1970 following heavy exploitation of the outstanding 1959 and 1960 year-classes, a period of strict regulation has seen an apparent recovery. Whether low stocks can produce good recruitment even when ecological factors are favourable is not yet certain. The dramatic collapse of the Peruvian anchoveta fishery after the mid-seventies poses the same problem, as also that of the Californian pilchard collapse in the early fifties.

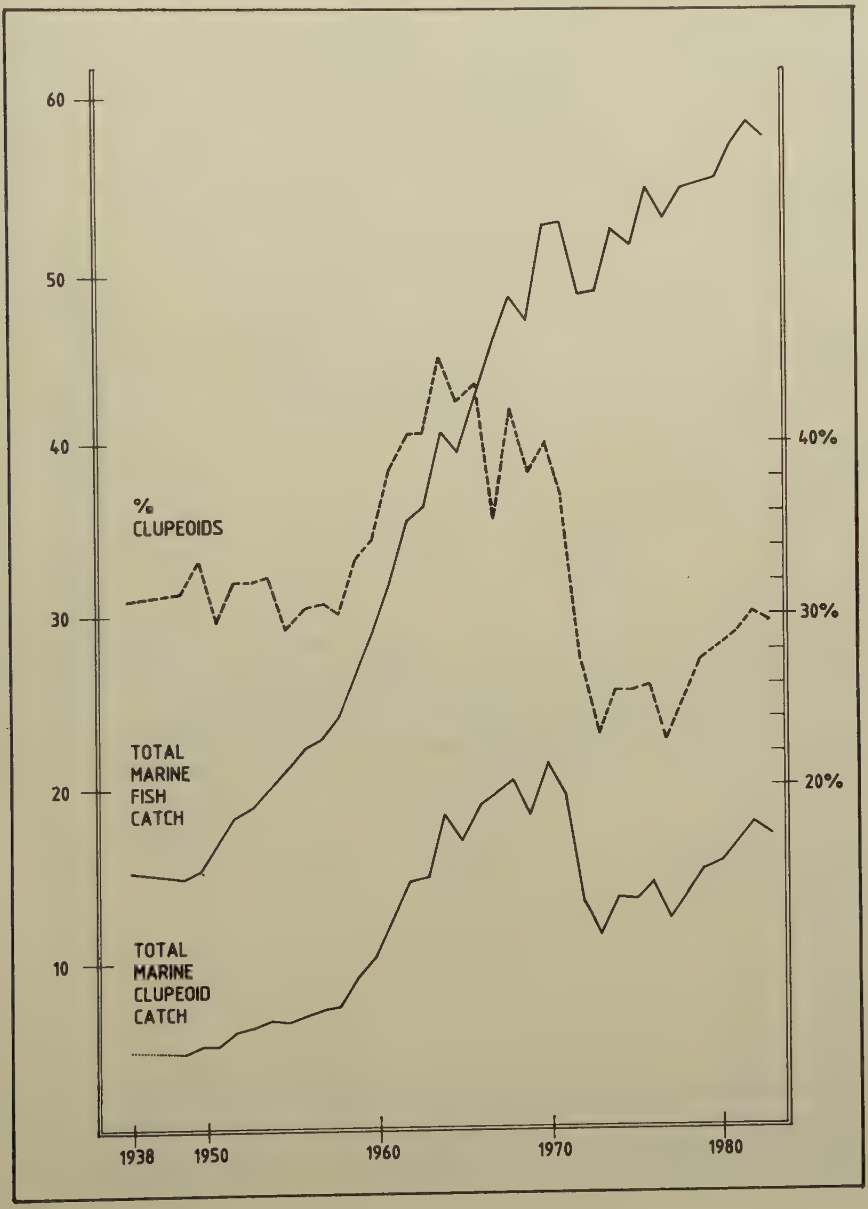


Fig. 5 World catches of marine fishes and of clupeoid fishes, 1938 and 1949-1983 (in millions of tons, on left). Also, the clupeoid catch as a percentage of world catch (% on right).

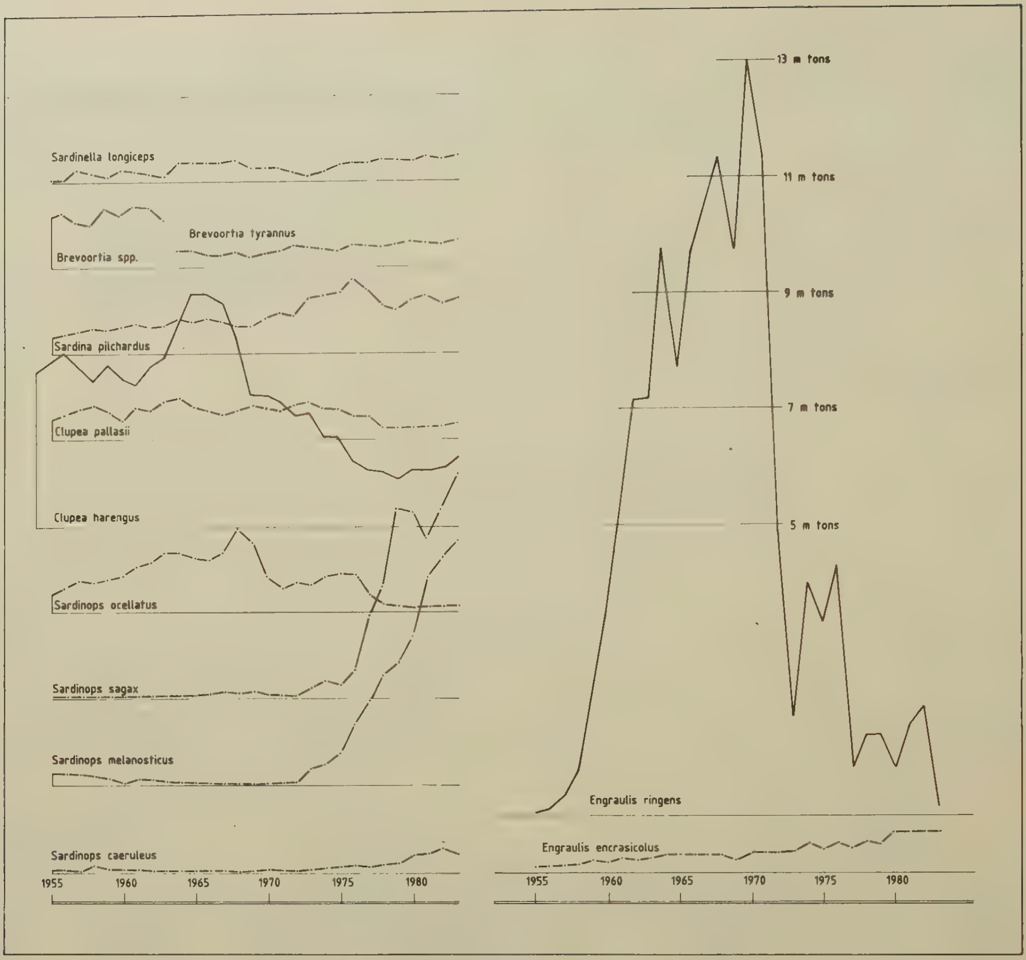


Fig. 6 Trends in catches of major clupeoid species, 1955-1983 (divisions on left are 500 000 tons)

Since members of the same clupeoid genus often have a fairly similar biology, and since sympatric members of a genus may not always have been separated in the catch statistics, it is of interest to know which genera play a major role in fisheries. In fact, 10 clupeoid genera, comprising about 36 species, contribute over 90% of the total world clupeoid catch (Fig. 7). The following figures show the catches for 1982:

Species	Catch in tons	% of total clupeoid catch
Sardinops (4 species)	7 820 021	41.4
Engraulis (6 species)	3 570 522	18.9
Brevoortia (3 species)	1 257 906	6.6
Clupea (2 species)	1 207 478	6.4
Sardinella (6 species)[1]	1 056 324	5.6
Sardina (1 species)	896 975	4.7
Opisthonema (2 species)	576 555	3.1
Sprattus (1 species)	525 135	2.8
Clupeonella (1 species)	434 655	2.3
Stolephorus (about 10 species)	231 344	1.2
		93.0

[1] Only S. aurita, S. brasiliensis, S. lemuru, S. longiceps, S. maderensis, S. neglecta

The order of these genera varies a little from year to year, depending on the state of the stocks. Other genera which have been of importance in previous years (i.e. a catch of over 100 000 tons) are the round herring Etrumeus (1 species), the wolf herrings (Chirocentrus, 2 species) and the African freshwater Stolothrissa and Limnothrissa (1 species each). Clearly these are the genera that merit further fishery, biological and taxonomic study.

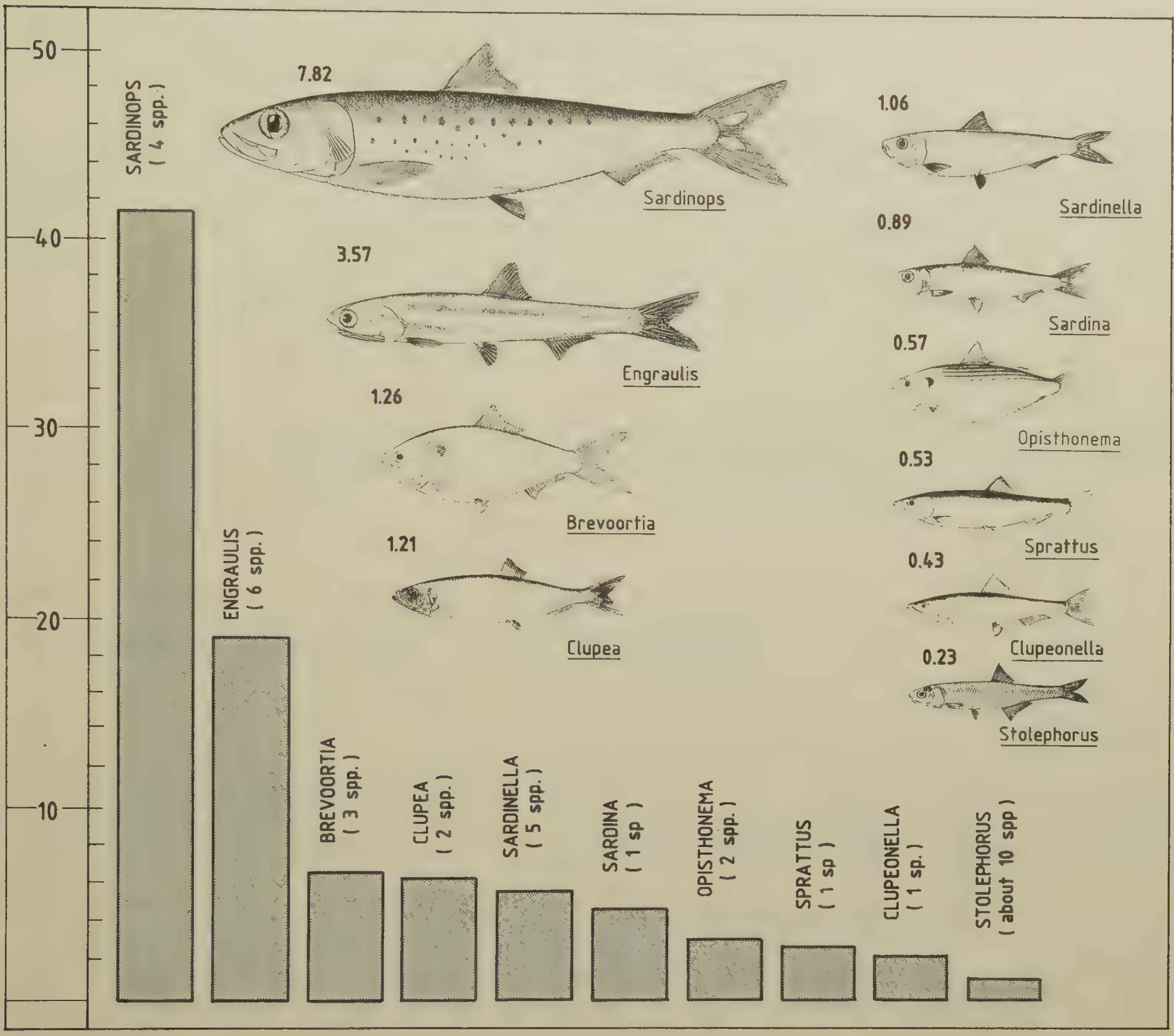


Fig. 7 Relative importance of the ten major clupeoid genera (as % of total clupeoid catch; fishes tagged with their catch in millions of tons; 1982 figures)

1.1.2 Fishing gear

Since clupeoids are mainly schooling fishes and thus most easily caught by nets, quite a wide variety of nets and netting techniques has been developed to suit particular environmental and economic restraints. Although the major clupeoid catches come from fully mechanized large-scale netting operations, it is worth recording also the small-scale artisanal gear which in human and nutritional terms is nevertheless important in many tropical and subtropical areas. Even when clupeoids are merely a bycatch in such artisanal gear, carful sorting can result in large baskets containing one or two species of small Stolephorus which are as much appreciated as the large 'table' fishes.

Surrounding nets : Used to encircle schools at or near the surface. There are two kinds, both usually set with a single boat (or with an auxillary craft).

Purse seine - a running line at the bottom of the wall of netting that has been set around the school closes the net like a purse. Used with or without a light to attract the fishes. Employed for the Sardinella fisheries off West Africa and the Sardinops and Engraulis fisheries off Peru, Chile and elsewhere.

Lampara net - no purse lines, but with a spoon-shaped small-meshed central bunt and slender wide-meshed lateral wings. Used with or without a light. Employed generally for the same clupeoids as the purse seine.

Seine nets : Used between surface and bottom, or at the bottom, to encircle schools, with or without a bag at the centre and usually hauled by a rope at each end. There are two methods of operation.

Beach seine - set from the land, either by wading or from a small boat, then hauled to the beach. Very commonly used in most tropical or subtropical areas for small inshore clupeoids (Sardinella, Herklotsichthys, Thryssa, Stolephorus, etc.).

Boat seine - operated from a boat, with long ropes to herd the fishes, usually hauled along the bottom; the most representative is the Danish seine (used for flatfishes, but less frequently for clupeoid fishes).

Trawlnets : Both bottom trawls and midwater trawls will catch clupeoid fishes, but apart from a few species subject to aimed fisheries they generally form a bycatch and are not economically exploited in this way.

Liftnets : Horizontal nets that are raised when fish are suspected to be over the net or have been attracted there by light. There four two main kinds.

Portable - small hand nets used from river banks, jetties, etc.

Boat-operated - bag nets and blanket nets worked from one or more boats. Extremely effective for small clupeoid fishes, especially if used with a light.

Shore-operated - portable or fixed; a horizontal net is lifted by an often ingenious counter-weight or is winched by hand or machine. Effective for small clupeoids, especially if used with a light. Employed in Southeast Asia.

Rig-operated - a large bamboo rig or tower in water of 5 to 15 m encloses a square net which can be winched up; from the platform on top a light is lowered to attract the fish. Common along the Java Sea coast of Indonesia, where they are called bagan. Effective for small clupeoids (especially Sardinella, Thryssa and Stolephorus).

Falling gear : Cast nets produce rather few clupeoids.

Gillnets : Vertically-hung nets, at the surface, midwater or bottom, with a mesh size that usually 'gills' a restricted size range of fishes; often set in long lines or 'fleets' of nets. Drifting gillnets (driftnets) were the traditional gear for the northern herring fisheries (Clupea). Short gillnets are also used in rivers, being drifted downstream to catch runs of anadromous fishes. They are used in this way for shads (Tenualosa species) in India.

Traps : Either with a non-return funnel or relying on the inability of the fish to turn and escape (aided by the pressure of the water current). Three main types catch clupeoids.

Fyke nets - conical non-return bag with wing(s) held apart by stakes; used in shallow water. Shads are sometimes caught in fyke nets.

Stow nets - conical or wedge-shaped nets frequently used in estuaries or lower parts of rivers where the current is strong, the net being held by stakes or anchors. Catches anadromous, euryhaline or riverine clupeoids. In some cases a basket is used rather than a net.

Barriers - estuarine barriers of stakes, reeds, etc., with wings to direct the fishes; they often catch inshore and mainly euryhaline clupeoids, particularly in tropical areas. River barriers or weirs with non-return or funnel-shaped baskets are used for anadromous clupeoids such as shads (e.g. Tenualosa ascending Indian rivers).

Hook-and-line : Although not important economically, it is of interest that some clupeoids will take a hook, as for example large pilchards in the northeast Pacific (Sardinops caerulea) or shads in Europe (Alosa species).

Pumps : Usually operated in conjunction with a light to attract schools. Employed on the Caspian Sea for chilka (Clupeonella species).

Explosives : Although illegal, explosives have been used instead of the liftnets from the Java Sea bagan towers.

Poisons : Some freshwater clupeoids occur in the more general catches made by poisons in tropical rivers.

1.1.3 Utilization of clupeoids

Clupeoid fishes contribute to world food resources in two ways: directly, through actual consumption (fresh, frozen or processed) and indirectly, by providing products used for animal feeds and fertilizers or by serving as bait to catch other fishes further up the food chain. Very small clupeoids may be consumed whole (e.g. whitebait Sprattus sprattus in Europe, small Stolephorus in southeast Asia); slightly larger clupeoids (e.g. pilchards, sardines, Sardina, Sardinops) may be processed so that all but the head is palatable; most medium and large species, however, are valued almost entirely for their epaxial and hypaxial body muscles, the head, guts, fins and axial skeleton being removed and the intermuscular bones largely ignored. Parts that are consumed or marketed separately are the gonads (e.g. the eggs of the Pacific herring Clupea pallasii from the Pacific coast of Canada) and oils or body fluids extracted from the liver and other tissues (e.g. from the menhaden Brevoortia tyrannus).

From earliest times the need to store clupeoid catches for later consumption necessitated some form of preservation. Nowadays a large part of the world clupeoid catch is processed in one way or another, most particularly in the case of the enormous single species fisheries of temperate waters (for Sardinops, Engraulis, Clupea, etc.). The tropical clupeoids, on the other hand, are more frequently eaten fresh (or after short storage in ice), not only because industrialization is generally less advanced in such areas, but also because catches are relatively smaller and the species composition is much more diverse; nevertheless a substantial proportion of the catch may be cured (often sun-dried or smoked), especially the smaller species. As clupeoid fisheries have developed (e.g. the Sardinella fisheries of West Africa), the investment in mechanized exploitation has had to be matched by that for storage and processing. The concommitant rise in price of the product has usually meant marketing in the developed countries.

Clupeoid fishes are utilized in ten main ways. For the main categories an approximate percentage is given below, although this can vary from year to year, depending on availability and market factors (especially prices). The collapse of the Peruvian anchoveta fishery led to a drop in fishmeal and fish oil production (Peru became a major fish oil importer in 1983), but price rises (e.g. by 51% for fish oil in 1983) probably stimulated meal and oil production from other species. New processing techniques, as also alternative sources (e.g. jojoba for vegetable oil), also vary patterns of utilization.

(Direct)

Fresh (17%): all species, although fresh consumption is minimal in some (e.g. menhaden).

Frozen (12%): most species, depending on the need to store or transport.

Cured (12%): numerous species, especially Clupea in northern waters and small clupeoids in the tropics; salted (dry or brine solution), smoked, sun- and/or wind-dried; also allowed to ferment to produce a condiment (Roman garam, Greek halec; southeast Asia nowadays) or a fish silage as an animal feed additive.

Canned (14%): industry dominated by scombrids and clupeoids, the latter including species of Clupea, Sprattus, Sardinella (chiefly the S. aurita complex), Sardina, Sardinops, Brevoortia and Engraulis (E. encrasicolus, also the Argentine E. anchoita); sardines and pilchards form almost half the canned small pelagics; packed mainly in vegetable oils, but also in tomato sauce, brine or water.

Minced : chiefly applied to gadoid fishes, but trials have been made with Clupea, Sprattus, Sardinella, Sardinops, Brevoortia, Engraulis and Thryssa; the flesh is separated in a cominuted form from skin, bones, scales and fins; various clupeoids used for fish paste (especially anchovies).

Fish flour : refinement of techniques used to produce animal feeds from whole degutted fishes, resulting in a useful protein additive for human consumption.

Oil : over 80% of the USA fish oil production has in some years come from the menhaden Brevoortia tyrannus (yielding 8 to 20 gallons of oil per 1000 fishes, depending on how far north the fishes are caught); body oils (used in paints, soap, shortenings and margarine) are also extracted from Sardinops and Engraulis; vitamin rich condensed fish solubles, serving as an animal feed additive, result from wet reduction of fishes such as menhaden.

(Indirect)

Animal feeds (44%) : chiefly Clupea, Sardinops, Brevoortia and Engraulis; the principal product from reduction plants, using either whole fish (with or without extraction of oil) or offal; used for supplementing feeds for cultured fishes (trout), poultry, cattle, sheep and pigs.

Fertilizers : herring in Scandinavia and menhaden on the eastern coast of North America have been used since earliest times, but the practice is relatively unimportant nowadays.

Bait : Sardinops and Engraulis used for 'chumming' tuna; species of Stolephorus used as live-bait, especially in southeast Asia.

1.2 Plan of the Catalogue

Four clupeoid families are presented: Chirocentridae, Clupeidae, Pristigasteridae and Engraulididae. For each family are given general descriptive remarks, notes on biology and fisheries, and a key to the subfamilies and genera. Thereafter, the genera are given in the same sequence as in the family (or subfamily) key, but the species within them are arranged alphabetically. For each genus a brief diagnosis is given which supplements the data in the key; also references to junior synonyms (some of which may still be in current use or entrenched in the older literature), notes on biology and fisheries, and a brief reference to the number of species, particular taxonomic problems, and any major revisional studies. Keys are not given to species since in many cases existing keys are unwieldy (especially in large genera such as Sardinella, Thryssa and Anchoa) or in need of further refinement; however, the species diagnoses contain comparisons with most species likely to be confused in the area. The information given for each species is arranged in the following paragraphs:

(1) **Scientific Name:** Reference is given to the first valid name applied to the species and its accompanying description; also, the type locality. Earlier but invalid names appear in the synonyms (where necessary).

(2) **Synonyms:** All names that have been applied to the species are given, as well as some different name combinations (if significant) with author, date, page number and usually a comment in parenthesis. The complete synonymies (i.e. all reference in the literature) of some clupeoid species are enormous and no purpose would be served in citing them in full; in any case, there is often grave doubt whether the material studied was really indentified correctly. Where possible, one or more references at the end of each synonym give the correct name and the author(s) who correctly described the species, discussed its synonyms or provided distributional or other data.

(3) **FAO Names:** Only English names have been chosen for use within FAO and to serve as the recommended names for fishery, marketing and other purposes. Some French and Spanish equivalent names for clupeoid fishes have already been given on FAO Identification Sheets, but it is considered premature to attempt this for all clupeoid species until fishery and other specialists in countries using French and Spanish can be consulted.

(4) **Diagnostic Features:** Distinctive features are given, accompanied where necessary by diagrams, as an aid to identifying species within a genus (after using the keys to families, subfamilies and genera). If the species is more fully described by an FAO Species Identification Sheet, reference is made at the end to the alpha-numerical FAO code of the species and the Fishing Area (e.g. 'see CLUP Spratel 2, Fishing Area 51' in the case of Spratelloides gracilis). In principle, the species is diagnosed to separate it from similar sympatric species and not from all other species in the genus (i.e. those that occur in other areas).

(5) **Geographical Distribution:** The general range of the species is given in the text and in the map (areas between scattered records may merit a question mark if a continuous range seems doubtful). Where appropriate, the list of species given after each genus is arranged geographically.

(6) **Habitat and Biology:** The true identity of the species is often in doubt, especially in the older literature, so that much apparently useful biological information has had to be omitted here. For very many of the tropical species, however, àlmost nothing is known of feeding habits, spawning reasons, migrations, tolerances and preferences for particular temperature or salinity ranges, etc.

(7) **Size:** The maximum known size and where possible the usual adult size are given (as standard length, in centimetres). As a rule the average adult size is generally about 1/4 less than the maximum.

(8) **Interest to Fisheries:** Partly based on the statistics by species and by Fishing Area given in the FAO Yearbook of Fishery Statistics for 1983. Since only 47 clupeoid species (out of over 300 described species) are given individual statistics, and since identifications are sometimes doubtful (i.e. more than one species probably included), only a general impression of the relative importance of a species is possible in many cases, or reference to a particular locality where significant catches were seen or reported. However, from fisheries literature for particular areas or particular species considerable information on size of fishery, gear and utilization is available. This has been included whenever identifications can be trusted.

(9) **Local Names:** These are only occasionally given, usually when a particular species is the basis for a major fishery and its identity is certain. In very many cases, however, a local name is applied to several clupeoid species and means no more than that the fish is a kind of sprat, sardine or anchovy.

(10) **Literature:** Reference is made to the most important (not only taxonomic) books or papers on the species, with a brief indication of their relevance in parentheses. Some or all may already have been cited under the synonyms, where the page reference is also given. See page 14 for list of major works.

(11) **Remarks :** Taxonomic or other problems are outlined here, e.g. explanations for unexpected name changes, doubtful status of species, indications of further work in progress or needed, and presence of subspecies (which are given a brief diagnosis and geographical range).

1.3 Problems of Identification

Many clupeoid species, especially those of tropical and subtropical waters where diversity is greatest, are difficult to identify, partly because the distinctions require a microscope or good hand lens (for gillraker numbers, shape of second supra-maxilla, form of scale striae, etc.), and partly because the taxonomy of some genera is not sufficiently well understood (e.g. the clupeid genera *Sardinella* and *Herklotsichthys*, or the engraulid genera *Thryssa*, *Anchoviella* and especially *Anchoa*).

The keys to families, subfamilies and genera have been based, where possible, on the most obvious external characters, but the longer generic keys (e.g. for the Clupeinae) may pose problems. However, since rather few genera are shared between the Indo-West Pacific and the New World, the distribution of the genera has often been introduced into the key. The elimination of genera (and species) not found within the area studied can often save time and side-step difficulties over unfamiliar characters. For this reason the occurrence of genera and species within the 19 marine and 9 freshwater FAO Fishing Areas is given (see Part 2). Having arrived at a particular genus by using the key, its occurrence in the area studies should be checked. This list will also help in narrowing down the number of species diagnoses that should be consulted, although this can also be done from the list of species given after each generic diagnosis.

Assuming that the correct genus has been found, a quick glance at the illustrations may suggest one or more likely species, especially if the shape or colour pattern is distinctive. The species diagnoses are designed to lead to the correct species or even genus, based on comparisons with similar species or genera sharing even a small part of the geographical range. However, the similarities of preserved specimens (on which many of the diagnoses are based) may be quite different from the similarities of fishes still in the net. It is as well, therefore, to check all the characters in the diagnosis of the compared species (or genus), where additional characters will be found.

Short-cuts to clupeoid identifications are regrettably few. Colour is generally of little help, but some clupeoids have characteristic black spots along the flanks (*Sardina*, *Sardinops*, *Amblygaster sirm*, some *Herklotsichthys*, some shads), and others have black tips to the tail (e.g. *Sardinella melanura*) or a bright silver stripe on the flank (*Lile* and some anchovies).

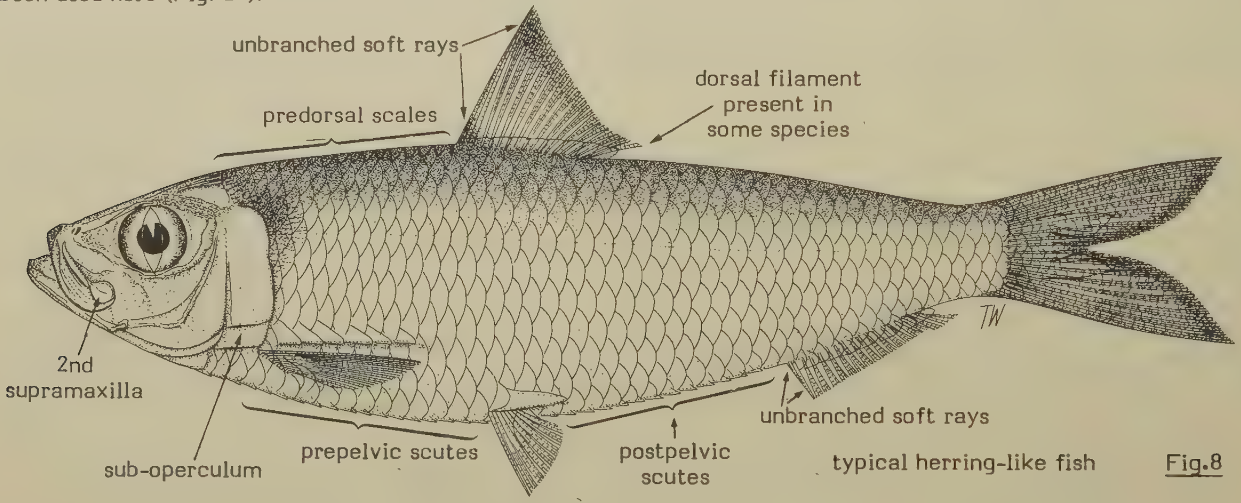
Among clupeids the number of pelvic finrays is often diagnostic of a genus or subfamily (but in anchovies there are always 7 finrays, except in *Coilia ramcarati* with 10). In the table below the counts are given for all clupeoids. A few characters may instantly diagnose certain species or genera, such as the canine teeth of *Chirocentrus*, *Lycengraulis* and *Lycothrissa*, the light organs of *Coilia dussumieri*, the rat-tail body of all *Coilia* or the enormously long upper jaw (maxilla) in *Thryssa setirostris*, but for the most part one must rely on tedious counts of finrays, gillrakers and scales, measurements of body proportions, and examination of small body parts. Much of the confusion in clupeoid literature is because workers did not always do this in the past.

Family	Pelvic finrays	Genera
CHIROCENTRIDAE	7	*Chirocentrus*
CLUPEIDAE		
(Dussumieriinae)	8	*Dussumieria*, *Etrumeus*, *Spratelloides*, *Jenkinsia*
(Clupeinae)	7	*Platanichthys*, *Ramnogaster*, *Escualosa*
	7 or 8	*Sprattus sprattus*
	8	All other *Sprattus*: *Harengula*, *Herklotsichthys*, *Opisthonema*, *Lile*, *Sardina*, *Sardinops*, *Rhinosardinia*, *Clupeonella*, *Amblygaster*, *Strangomera*, most *Sardinella*
	9	*Sardinella aurita*, *S. brasiliensis*, *S. lemuru*, *S. longiceps*, *S. neglecta*; *Clupea* (occasionally 8 or 10)
(Pellonulinae)	7	*Sierrathrissa*, *Clupeichthys perakensis*
	7 or 8	*Thrattidion*
	8	All other *Clupeichthys*; all other genera
(Alosinae)	7	*Brevoortia*, *Ethmidium*
	8	*Ethmalosa*, *Hilsa*, *Tenualosa*, *Gudusia*
	9	*Alosa*
(Dorosomatinae)	8	All genera

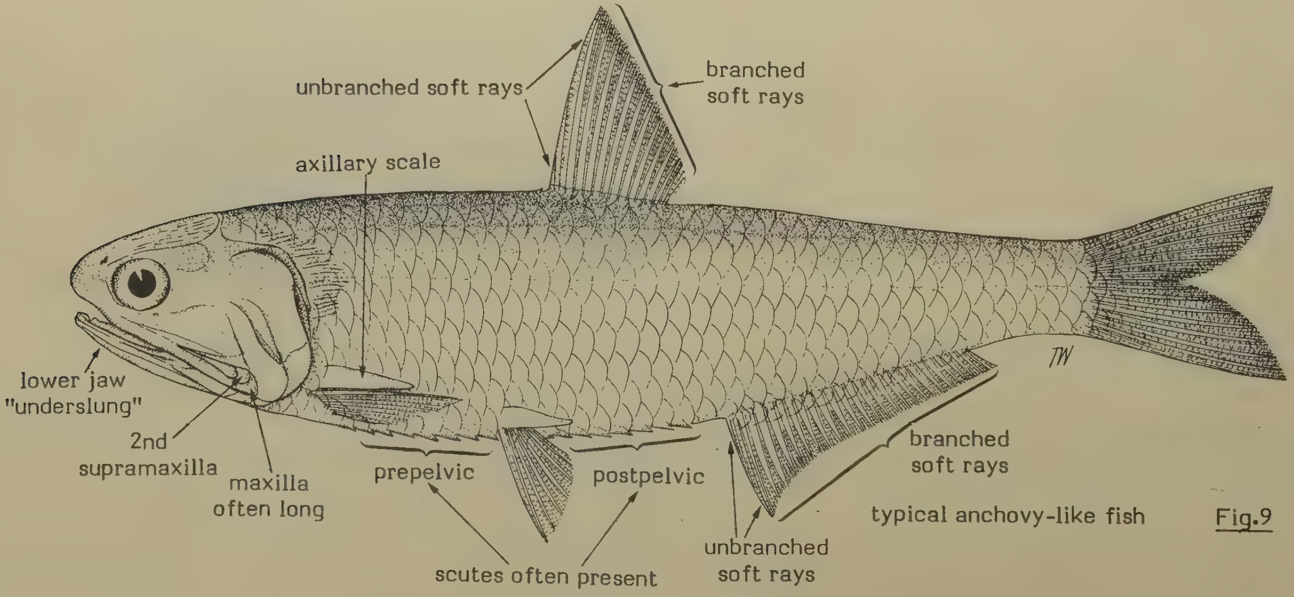
Family	Pelvic finrays	Genera
PRISTIGASTERIDAE	6	Chirocentrodon; Pellona harroweri
	6 or 7	Ilisha
	7	Pellona
	(absent)	Pliosteostoma, Odontognathus, Neoopisthopterus, Opisthopterus, Raconda; some specimens of Pristigaster (if present, then 5)
ENGRAULIDIDAE		
(Engraulidinae)	7	All genera
(Coilinae)	7	Coilia (except one species)
	10	Coilia ramcarati

1.4 Technical Terms, Measurements and Counts

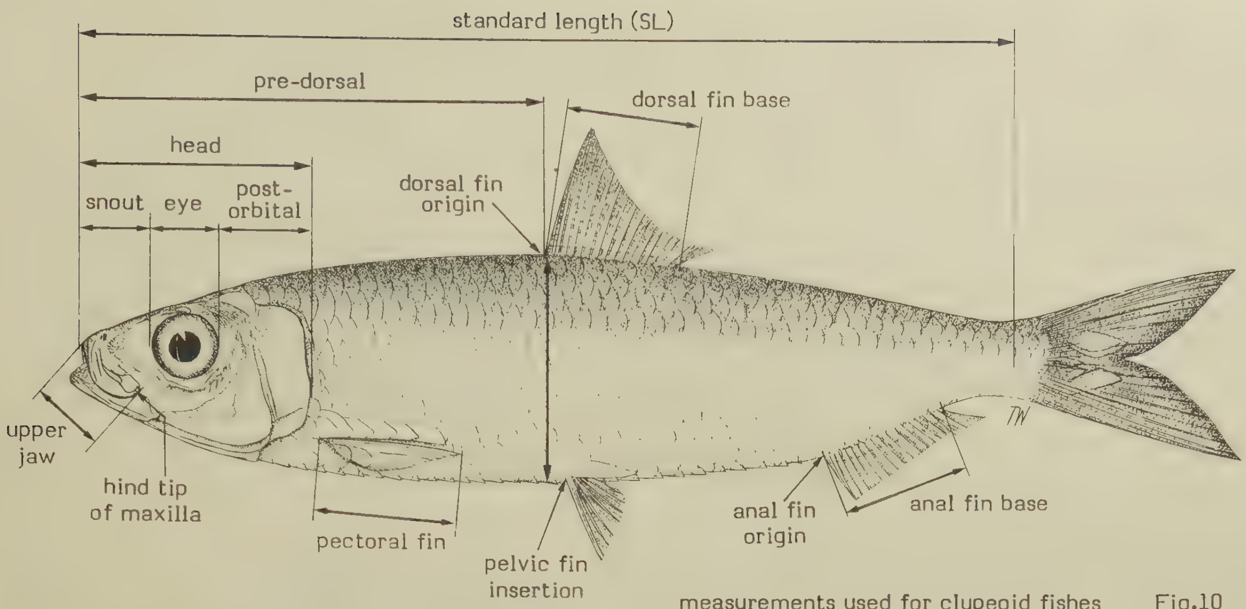
A typical herring and a typical anchovy are shown in Figs 8 and 9. In many taxonomic works on clupeoids a large number of external features are given, either as percentages or in the older literature as proportions of standard length, or of head length; in some cases one body part can be expressed as x times larger than another (or contained x times within it). Of such proportional measurements, the following are the most useful and have been used here (Fig. 10).


unbranched soft rays
predorsal scales
dorsal filament present in some species
2nd supramaxilla
sub-operculum
prepelvic scutes
postpelvic scutes
unbranched soft rays
TW

typical herring-like fish Fig.8


unbranched soft rays
branched soft rays
axillary scale
lower jaw "underslung"
2nd supramaxilla
maxilla often long
prepelvic
postpelvic
scutes often present
unbranched soft rays
branched soft rays
TW

typical anchovy-like fish Fig.9



measurements used for clupeoid fishes Fig.10

Standard Length - tip of snout to end of body, i.e., to base of caudal fin (where the finrays reach the hypurals). Bending the tail produces a wrinkle at this point.

Body depth - measured at deepest point, usually under origin of dorsal fin. Fishes are described here as slender when the depth is less than about 25% of standard length; moderately slender at 25 to 30% of standard length; moderately deep at 30 to 35%; deep at 35% or more.

Head length - the longest possible measurement, from tip of snout to hind border of gill cover (thus not always a horizontal measurement).

Snout versus eye - tip of snout to front border of eye, compared with the horizontal diameter of the eye. Most usefully expressed as the one larger than the other.

Upper jaw - from tip of snout to hind tip of maxilla, but most often expressed as the point reached by the maxilla, e.g. to beyond hind border of eye, to hind border of gill cover, etc.

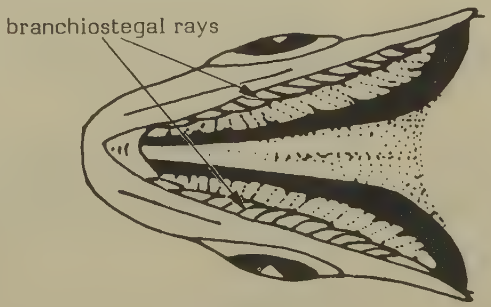
Post-orbital - from hind border of eye to hind border of gill cover, the longest measurement (thus not always horizontal).

Fin positions - the origins of the dorsal and anal fins, and the insertions of the pectoral and pelvic fins (their vertical position along the axis of the body) are either compared relative to each other, e.g. pelvic fin insertion in advance of dorsal fin origin, anal fin origin behind dorsal fin base); or given as a pre-pectoral, pre-dorsal, pre-pelvic or pre-anal distance (percent of standard length or for the dorsal origin often given as before or behind midpoint of body

Fin bases - the distance between the first and last finray bases. Rather than give finray numbers, it is often easier to state that the anal fin base is longer (or shorter) than the dorsal fin base

Finrays - in the dorsal and anal fins the first two, three or four finrays are unbranched (the first very small and easily missed), the remainder being branched (the last sometimes branched near its base, thus appearing as two, but counted as one). The first pectoral and pelvic finrays are also unbranched. The counts are given in the form iii 12 to 15 or i 17, etc., to indicate unbranched and branched finrays. This eliminates doubts about the first often minute unbranched finray since the first branched finray is always obvious.

Branchiostegal rays - these support the gill membrane that seals the underside of the gill cavity. Since the membranes on each side are not joined in the middle (except in the anchovy Cetengraulis), they tend to cling to the gill cover when this is opened up and so must be pulled inward to expose the branchiostegal rays. However, most clupeoids have about 6 or 7 branchiostegal rays, so that the high number in round herrings (11 to 17) is fairly obvious (Fig. 11).



underside of head

Gillrakers - unless stated otherwise, these are the numbers of gillrakers on the *lower* half of the first gill arch, i.e. on the ceratobranchial, which are much easier to count than those on the upper half, i.e. on the epibranchial bone. At the angle of the arch the curved bases of the gillrakers show whether they belong to the upper or the lower series (Fig. 12).

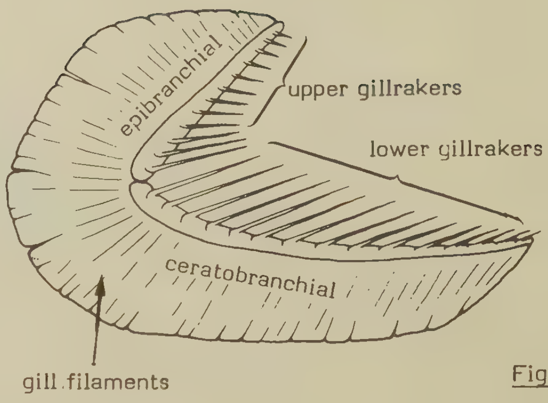


Fig. 12

Scales - there are no pored lateral line scales along the flank, but a count of scales along the midline of the flank (in lateral series) is sometimes diagnostic. However, since clupeoids often lose their scales, this has been avoided wherever possible and reference merely made to the presence of very small or very large scales.

Scutes - all clupeoids (except *Chirocentrus*) have a pelvic scute immediately in front of the pelvic fins.In most clupeoids the scutes continue forward to the gill opening to form the pre-pelvic series (including the pelvic scute); behind the pelvic scute is a small scute between the pelvic fins and this is the first of the post-pelvic series. Counts are usually given in the form 13 or 14 + 10 to 12, or sometimes 13 or 14 + 10 to 12 = 23 to 26 to indicate pre-pelvic, post-pelvic and total scutes (Fig. 13). In a few species scutes are present on the back, from the origin of the dorsal fin forward to the head.

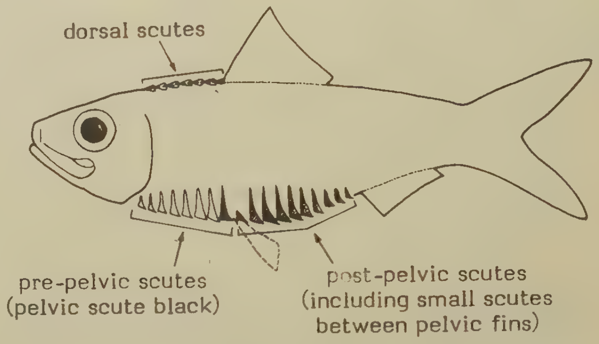


Fig. 13

Many other and often small characters are used in the keys and diagnoses, but are illustrated at the appropriate place. Wherever possible, non-technical terms are used, e.g. gill cover, gill opening, upper jaw, lower part of gill arch, etc., unless specific reference must be made to the operculum, maxilla, epibranchial gillrakers, etc. Similarly, terms like anterodorsal or posteroventral have been avoided.

1.5 Literature

The taxonomic, biological and fishery literature on clupeoid fishes is enormous. For example, over five hundred books, papers and reports up to 1984 contain data on merely the 11 species of clupeoids occurring off the western coasts of Africa. If this is multiplied up for more than three hundred species of clupeoid fishes in the world, then nearly seventeen thousand books, articles and reports have made some contribution to our knowledge of these fishes. In several geographical areas, however, attempts have been made to summarize these data. These major reference works have been cited in the synonymies in order to show where the taxonomy has now changed and different names are applicable; such works often contain valuable biological information, which may not have been significantly updated in the last two or three decades. In addition to these works, the biologist or fishery worker can also use the *FAO Identification Sheets* in five major fishing areas. Since identification of clupeoid species is simplified by elimination of those not found in the area under study, the major reference works and *Identification Sheets* are listed here by geographical area.

A. INDO-WEST PACIFIC

1. *General* (excluding cool-water species of Japan and Australia)

Wongratana, T., 1980. *Systematics of clupeoid fishes in the Indo-Pacific region.* Ph.D. thesis, Imperial College of Science and Technology, London, 2 vols. Keys, diagnoses, line drawings, maps, meristic counts for 154 species. The clupeoid worker's *vade mecum*, but still unpublished. The 24 new species and one new name were published in *Jap.J.Ichthyol.*, 29(4):385-407, 25 figs (1983).

2. *Western Indian Ocean* (Area 51)

FAO Species Identification Sheets for Area 51, 5 vols, 1984. Clupeoids by P.J.P. Whitehead and T. Wongratana. Keys, diagnoses and biological and fishery notes for 42 clupeoids (all illustrated).

SFSA. Sea fishes of southern Africa (in press). A totally revised edition of J.L.B. Smith's classic work. Keys, diagnoses, line drawings for 18 clupeoid species (all illustrated), by P.J.P. Whitehead and T. Wongratana.

3. Northern and Central Indian Ocean (Areas 51, 57 - in part)

Whitehead, P.J.P., 1973. A synopsis of the clupeoid fishes of India. J.mar.biol.Assn India, **14**(1):160-256. Keys, line drawings, literature for 68 clupeoid species; still useful, but in part superceded by Wongratana's thesis (see item A 1 above).

4. Eastern Indian ocean, Western Central Pacific (Areas 57, 71)

FAO Species Identification Sheets for Areas 57, 71, 4 vols., 1974. Clupeoids by P.J.P. Whitehead. Keys, diagnoses and biological and fishery notes for 40 clupeoids (all illustrated); much of it superceded by Wongratana's thesis (see item A 1 above).

5. Northwest Pacific (Area 61)

Warm-water species included in Wongratana's thesis, but there is no modern work devoted to the clupeoids of China, the Koreas and Japan.

Svetovidov, A.N., 1963. Fauna of the USSR. Fishes, **2**(1), Clupeidae. Zool.Inst.Acad.Sci.USSR, new series No. 48, published for the National Science Foundation by the Israel Program for Scientific Translantions, Jerusalem, 428 pp. (English translation from 1952 Russian original). Keys, half-tone figures, line drawings, literature for 6 clupeoids from Area 61.

6. Southwestern Pacific (Area 81)

No modern work on all the clupeoids of New South Wales and New Zealand. Munro (1956) described and figured 40 Australian clupeoids, but in many cases the names given must be updated from Wongratana's thesis (see item A 1 above).

B. EASTERN PACIFIC

1. General. No single modern work on the clupeoids of this region.

2. Northeastern Pacific (Area 67)

Clemens, W.A. & G.V. Wilby, 1967. Fishes of the Pacific coast of Canada, 2nd ed., Bull.Fish.Res.Bd Can., (68):1-443. Descriptions, photographs, biological data for the four clupeoid species from this area (pp. 99 to 105).

Hart, J.L., 1973. Pacific fishes of Canada. Bull.Fish.Res.Bd Can., (180):1-740. Keys, descriptions, line drawings, biological data and bibliography (extensive) for the four clupeoid species from this area (pp. 94-106). One of the best works of its kind.

3. Eastern Central Pacific (Area 77)

(California)

Miller, D.J. & R.N. Lea, 1972. Guide to the coastal marine fishes of California. Fish Bull.Calif., (157):1-235. Illustrated keys, brief descriptions and distribution notes for the 12 clupeoids of this area (pp. 54-57).

(Mexico to Panama)

Anon., 1976. Catalogo de peces marinos Mexicanos. Secretaría de Industria y Comercio, Instituto Nacional de Pesca, Mexico, 462 pp. Keys, distribution notes and photographs for 8 Pacific coast clupeoids of Mexico (pp 67-70, figs 60-75).

Meek, S.E. & S.F. Hildebrand, 1923. The marine fishes of Panama. Publs Field Mus.nat.Hist. (zool.Ser.), **15**(215), Pt 1:1-330. Keys, descriptions and a few illustrations of 22 Pacific coast clupeoids of Panama (pp. 179-214). Nomenclature outdated, but useful in conjunction with Peterson (see below).

Peterson, C.L., 1956. Observations on the taxonomy, biology, and ecology of the engraulid and clupeid fishes of the Gulf of Nicoya, Costa Rica. Bull.inter-Am.trop.Tuna Commn, **1**(5):137-280. Keys, distribution and biological notes for 23 Pacific coast clupeoids of Costa Rica. The best general work for this region, but lacks illustrations.

(Ecuador to Peru)

Cobo, M. & S. Massay, 1969. Lista de los peces marinos del Ecuador. Boln cient.tecn.Inst. nac.Pesc.Ecuador, **2**(1):1-68. List of 22 clupeoids (7 illustrated) from Ecuador coasts; the nomenclature usefully updates that of Meek & Hildebrand (Panama) and Hildebrand (Peru).

Hildebrand, S.F., 1946. A descriptive catalogue of the shore fishes of Peru. Bull.U.S.natn. Mus., (189):1-530. Keys and descriptions of 14 clupeoids (6 illustrated) from Peruvian coasts (pp. 80-105). Still the most useful work for this region.

4. Southeastern Pacific (Area 87)

Much of the older Chilean literature is assembled by Delphin (1901:39-42 for clupeoids) and by Fowler (1945:1-6 for clupeoids), but there are no keys and the nomenclature is outdated; the same applies to Mann (1954).

Boré, R. & F. Martinez, 1981. Chilean fisheries resources catalogue. Corporación de Fomento de la Producción, Instituto de Fomento Pesquero, Chile, unpaged. Descriptions and biological and fishery notes for 4 clupeoids (all with excellent colour photographs) of this region.

De Buen, F., 1958. Peces de la superfamilia clupeoidae en las aguas de Chile. Revta Biol. Mar., **8**(1-3):83-110. Keys and descriptions of all five clupeoids (no illustrations) of this region.

Leible, M. & E. Alveal, 1982. Catalogo de peces que habitan las aguas costeras y dulceacuicolas en la provincia de Concepción. Pontificia Universidad Catolíca de Chile, Departamento de Biología y Tecnología del Mar, Talcahuano, 104 p. Keys, descriptions, biological and fishery notes for four clupeoids (all illustrated) of this region (pp. 12-21).

C. WESTERN ATLANTIC

1. General. No single modern work on the clupeoids of this region.

2. Northwestern Atlantic (Area 21)

FWNA Fishes of the western North Atlantic, 1964. Sears Foundation for Marine Research, Yale University, Memoir 1 (3), 630 p. Keys, diagnosis and biological and fishery notes for 79 clupeoids (all illustrated) for this region and the northern part of Area 31 (pp. 148-454, authors S.F. Hildebrand, L.R. Rivas and R.R. Miller). In parts outdated, but still an excellent guide.

Liem, A.H. & W.B. Scott, 1966. Fishes of the Atlantic coast of Canada. Bull.Fish.res. Bd Can., (155):1-485. Keys, descriptions and biological and fishery notes for 7 clupeoids (all illustrated) of this region.

3. Western Central Atlantic (Area 31)

FWNA, 1964 (see item C 2 above), which covers also the northern part of this area.

Cervigón, F., 1966. Los peces de Venezuela, 2 vols, Fondo de Cultura Cientifica, Caracas. Keys and descriptions for 28 clupeoids (12 illustrated) from this region (pp. 114-149 and 925-926).

Whitehead, P.J.P., 1973. The clupeoid fishes of the Guianas. Bull.Br.Mus.nat.Hist.(Zool.), Suppl. 5:1-227. Keys and descriptions of 37 clupeoids (all but one illustrated) from the southern part of Area 31.

FAO Species Identification Sheets for Area 31, 6 vols, 1978. Clupeoids by P.J.P. Whitehead. Keys, diagnoses and biological and fishery notes for 31 clupeoids of this area (all illustrated).

4. Southwestern Atlantic (Area 41)

Figueiredo, J.L. & N.A. Menezes, 1978. Manual de peixes marinhos do sudeste do Brasil, **2**(1). Museu de Zoologia, Universidade de São Paulo, Brazil. Keys and descriptions of 21 clupeoids (all but one illustrated) from this region (freshwater species not included) (pp. 21 to 32).

Ringuelet, R.A., R.H. Arámburu & A.A. Arámburu, de, 1967. Los peces Argentinos de agua dulce. Comisíon de Investigación Científica, Buenos Aires, 602 pp. Keys and descriptions of 7 freshwater or euryhaline clupeoids (4 illustrated) of Argentina (pp. 52-65).

Menni, R.C., R.A. Ringuelet & R.A. Arámburu, 1984. Peces marinhos de la Argentina y Uruguay. Editorial Hemisferio Sur, Buenos Aires, 395 pp. Records of 18 clupeoids (13 figures) of this region (pp. 107-110)

Bellisio, N.B., R.B. López & A. Torno, 1979. Peces marinos Patágonicos, Secretaría de Estado de Intereses Marítimos, Ministerior de Economía, Buenos Aires, 279 pp. Descriptions and biological and fishery notes for 2 clupeoids (both illustrated) of this region (pp. 53-58).

D. EASTERN ATLANTIC

1. General. No single modern work on all the clupeoids of these two areas.

2. Northeastern Atlantic and Mediterranean (Areas 27, 37)

Svetovidov, A.N., 1963 (see item A 5 above). Keys, descriptions and a great deal of biological and fishery data for 18 marine and freshwater clupeids (all illustrated) of the northeast Atlantic and Black Sea.

Banarescu, P., 1964. Fauna Republicii Populare Romine. Pisces-Osteichthyes (pesti ganoizi si ososi), **13**, Editura Academiei Republicii Populare Romine, Bucharest, 959 pp. Keys, descriptions and biological notes for 8 clupeoids (all illustrated) of the Black Sea (pp. 223-251).

Wheeler, A.C., 1978. Key to the fishes of northern Europe, Frederick Warne, London, 380 pp. Keys, descriptions, and brief notes for 6 clupeoids (all illustrated) of northern European coasts (pp. 66-71)

FAO Species Identification Sheets for Area 37, 2 vols., 1973. Clupeoids by A.N. Svetovidov. Descriptions and biological and fishery notes for 6 clupeoids (all illustrated) in this area.

CLOFNAM Checklist of the fishes of the north-eastern Atlantic and Mediterranean, 2 vols., 1973. Clupeoids mainly by A.N. Svetovidov, also P.J.P. Whitehead & A. Ben-Tuvia. Virtually complete compilation of taxonomic literature, including that for 13 clupeoids of the northeastern Atlantic and Mediterranean (pp. 99-112).

FNAM, Fishes of the north-eastern Atlantic and Mediterranean, 1st vol., 1984. Clupeoids by P.J.P. Whitehead. Keys, diagnosis and notes on biology for the 14 clupeoids (all illustrated) for the CLOFNAM area.

3. Eastern Central Atlantic (Areas 34 and 47 in part)

FAO Species Identification Sheets for Areas 34, 47 (in part), 6 vols, 1981. Clupeoids by P.J.P. Whitehead. Keys, diagnosis and biological and fishery notes for the 11 clupeoids (all illustrated) of this area.

CLOFETA, Check-list of the fishes of the eastern tropical Atlantic (in press). Clupeoids by P.J.P. Whitehead. Virtually complete compilation of taxonomic literature, including that for the 11 clupeoids of this area.

4. Southeastern Atlantic (Area 47)

All clupeoids are covered by the two works above (item D 3)

E. FRESHWATERS

1. Africa (Area 01)

CLOFFA, Checklist of the freshwater fishes of Africa, 1st vol., 1984. Clupeoids by M. Poll, G.G. Teugels & P.J.P. Whitehead. Virtually complete compilation of taxonomic literature for 39 freshwater or euryhaline clupeoids of Africa (pp. 41-56)

2. North and South America (Areas 02, 03)

No special work, but freshwater or euryhaline clupeoids included in the literature cited already.

3. Asia (Area 04)

   All tropical or subtropical freshwater or euryhaline clupeoids included by Wongratana (see item A 1 above).

4. Europe (Areas 05, 07)

   All freshwater or euryhaline clupeoids included by Svetovidov (see item A 5 above; see also item D 2).

5. Australia (Area 06)

   No special work, but some species included by Wongratana (see item A 1 above).

1.6 Acronyms

The following six multi-authored works are more readily recognized by their titles than by their editor(s) or even their authors. To save space, however, especially in the synonymies, these works are cited by their acronyms. This seems more immediately informative, especially when there may be numerous other papers by the same author. The six works are:

CLOFETA (in press). Check-list of the fishes of the eastern tropical Atlantic, Unesco, Paris. Edited by J.-C. Quéro.

CLOFFA, vol. 1, 1984. Check-list of the freshwater fishes of Africa, Musée Royale d'Afrique Centrale, Brussels & ORSTOM, Paris. Edited by J. Daget, J.P. Gosse & D.F.E. Thys van den Audenaerde.

CLOFNAM, 1973. Check-list of the fishes of the north-eastern Atlantic and of the Mediterranean, Unesco, Paris. Edited by T. Monod & J.C. Hureau.

FNAM, vol. 1, 1984. Fishes of the north-eastern Atlantic and Mediterranean, Unesco, Paris. Edited by P.J.P. Whitehead, J.C. Hureau, J. Nielsen & M.-L. Bauchot.

FWNA, part 3, 1964. Fishes of the western North Atlantic, Sears Foundation for Marine Research, Yale University. Edited by H.B. Bigelow *et al.*

SFSA (in press). Sea fishes of southern Africa, Grahamstown. Edited by P. Heemstra.

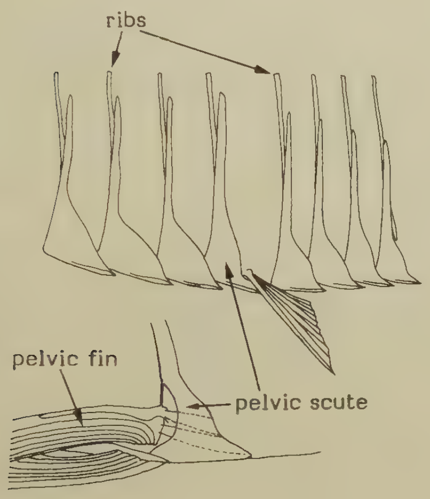
Acknowledgements

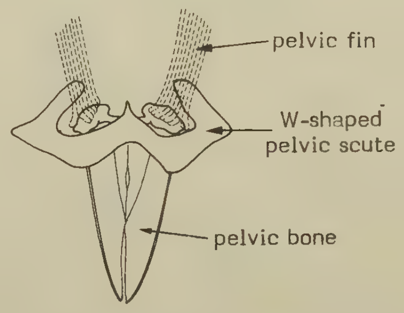
Taxonomy is a creative and not merely an applied science, but only in its application does it finally justify the labour expended. It has been a privilege, therefore, to participate in what must now qualify as one of the most important programmes for the application of fish taxonomy. To an overall appreciation of the role played by Dr Walter Fischer (FAO, Rome) in initiating the Catalogue series and related works in this programme, I must add three personal debts: first for persuading me that a synopsis of clupeoid fishes was not premature, second for doing so with such irresistible drive and enthusiasm, and third for providing his considerable editorial skills during the gestation of this work. No less a debt is owed to Dr Thosaporn Wongratana (Chulalongkorn University, Bangkok), who graciously allowed me to use all his drawings of Indo-Pacific clupeoids - the finest such drawings ever made; his revision of these fishes (with occasional differences of opinion) underpins the taxonomy adopted here. The remaining drawings, except for a few by myself, were occasionally taken direct from the literature, but mostly were carefully redrawn from various sources by Mr Oliviero Lidonnici (FAO, Rome), who also redrew all my small sketches; Mr Paolo Lastrico is also thanked for his valuable assistance in various aspects of the artwork. Help with fishery statistics, types of gear and modes of utilization was kindly given by FAO staff, in particular Mrs Fiorenza de Luca, Mr J. Prado and Ms Helga Josupeit. Ms Claire Cuerden and her staff in the FAO Fisheries Branch Library, and Ms Gloria A. Soave gave assistance with the bibliography. Finally, the typing of the manuscript (literally hand-written) and the complex setting of text and figures on the pages, were undertaken with great skill, speed and remarkable cheerfulness by Mrs Giulia Sciarappa-Demuro (FAO, Rome).

2. ORDER CLUPEIFORMES - SUBORDER CLUPEOIDEI

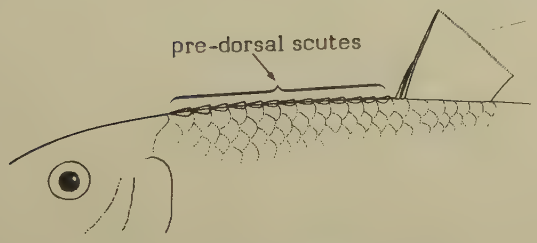
Moderate-sized or small or very small fishes (2 to 100 cm standard length) with no spines in the fins, the dorsal fin single and short (11 to 23 finrays) and usually near the midpoint of the body (further back in Chirocentridae and some Pristigasteridae, the latter including *Raconda* without a dorsal fin); the pelvic fins small (6 to 10 finrays), a little before, under or a little behind the dorsal fin base (but absent in some Pristigasteridae); the anal fin usually short or moderate (10 to 36 finrays), but longer in some Pristigasteridae (34 to 93) and some Engraulididae (14 to 81, or about 100 in *Coilia*); the caudal fin forked (except rhomboid in *Coilia*).

The body is usually fusiform, sometimes almost round in cross-section (some *Dussumieria*, *Etrumeus*, also *Engraulis*), but more often compressed, sometimes highly compressed (Chirocentridae, some Pristigasteridae). Typically, there is a pelvic scute with ascending arms just in front of the pelvic fins (absent in Chirocentridae; W-shaped in the Dussumieriinae, and a series of similar scutes in front of the pelvic fins and behind them, but absent in the Dussumieriinae, some Pellonulinae, *Engraulis*, some specimens of *Stolephorus purpureus* and all New World Engraulididae; the scutes do not reach forward to the isthmus in some Engraulididae. Fossil clupeoids (e.g. the Eocene *Knightia*) had a series of scutes from the occiput to the dorsal fin origin; such a complete dorsal series occurs in the Pellonulinae (*Potamalosa*, *Hyperlophus*) and the Alosinae (*Ethmidium*), while the Dorosomatinae (*Clupanodon*), Clupeinae (*Harengula* and others) and Pristigasteridae (*Pristigaster*) include species with one, two or a few pre-dorsal scutes; in the Engraulididae, some *Stolephorus* and all other Indo-Pacific genera have a single spine-like scute just before the dorsal fin.

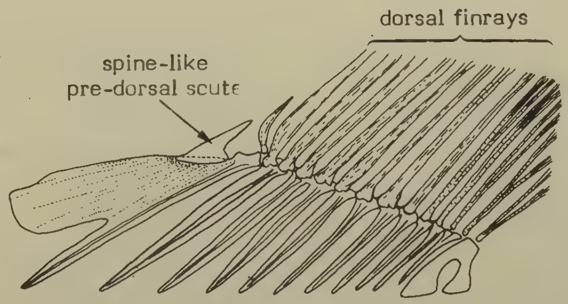




Dussumieria, *Etrumeus*, *Spratelloides*, *Jenkinsia*

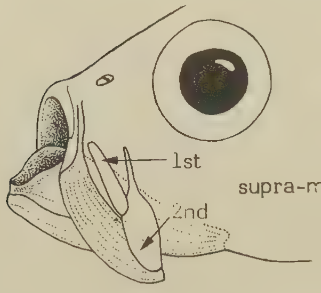


Potamalosa, *Hyperlophus*, *Ethmidium*

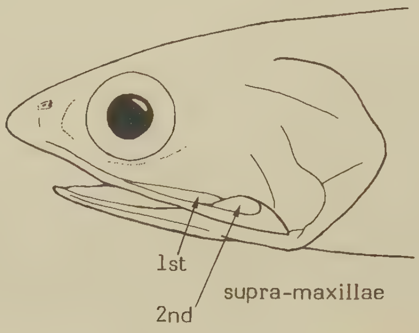


Thryssa, *Setipinna*, etc.

The mouth is small, with the lower jaw deep and triangular in the Chirocentridae, Clupeidae and Pristigasteridae, but slender and long in most Engraulididae. The pre-maxillae are triangular (but rectangular in Dussumieriinae) and the maxillae usually have an anterior (first) and posterior (second) supra-maxilla along the upper edge. Small conical teeth are typically present in the jaws and on the vomer, palatines and endo-and ectopterygoids (i.e. the roof of the mouth), but some or all may be absent, or the jaws may bear canine teeth (Chirocentridae, also *Chirocentrodon* of the Pristigasteridae and both *Lycengraulis* and *Lycothrissa* of the Engraulididae). The gut may be short (carnivores) or long and coiled (phytoplankton feeders, filter feeders) and in some the stomach is muscular like a gizzard (Dorosomatinae; partially so in some Clupeinae); food is collected in a bolus by pharyngeal pouches in the Dorosomatinae and some Clupeinae. A swimbladder is present, sometimes double-chambered (some Engraulididae), with a pneumatic duct joined to the oesophagus or stomach blind-sac; in the Pristigasteridae (*Ilisha*) some species have one or a pair of post-coelomic tubes extending from the hind end of the swimbladder back into the muscles of the body.


1st
supra-maxillae
2nd

Clupeidae


1st
supra-maxillae
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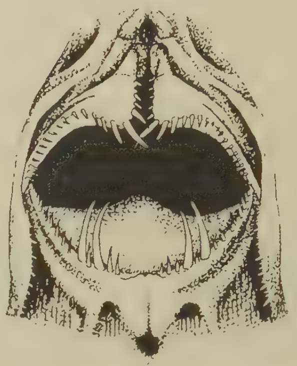
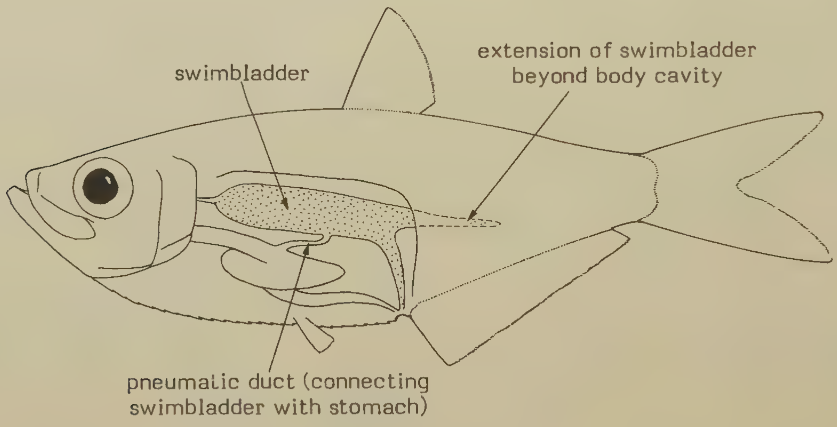
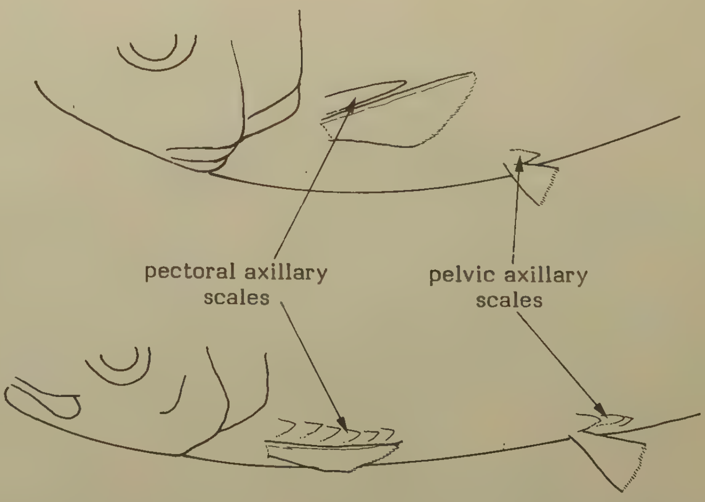
Engraulidae



Chirocentrodon


swimbladder
extension of swimbladder beyond body cavity
pneumatic duct (connecting swimbladder with stomach)

Almost all species have a complete covering of cycloid scales on the body (mostly lost in *Thrattidion* and *Sierrathrissa* of the Pellonulinae), which are frequently deciduous; small scales occasionally cover the bases of the dorsal, anal and/or caudal fins, and one or sometimes several axillary scales lie above the bases of the first pectoral and pelvic finrays. There is no lateral line canal with pored scales along the flanks (occasionally one or two behind the gill opening). A branching and mainly cutaneous sensory canal system covers the top and sides of the head; the supra-orbital, infra-orbital, pre-opercular and pterotic canals all meet in the *recessus lateralis*, a special chamber characteristic of clupeiform fishes, its inner wall being a membrane sealing the perilymphatic space that surrounds the inner ear.

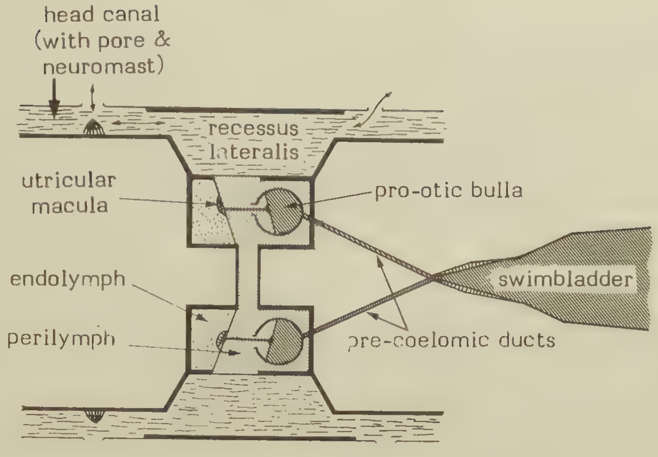

pectoral axillary scales
pelvic axillary scales

Two important internal features characterize the Clupeoidei:

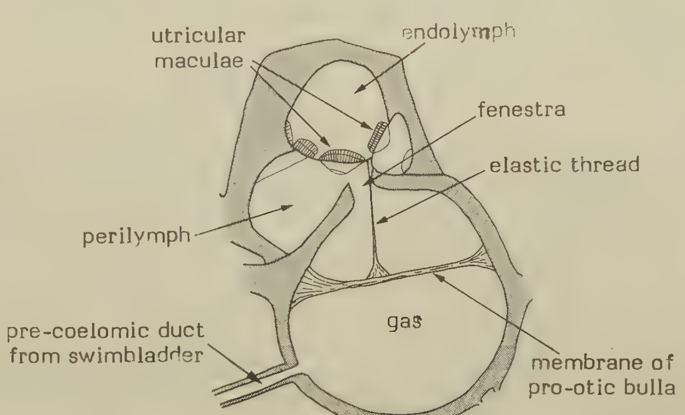
(a) A pair of fine tubes from the front of the swimbladder penetrate the skull and expand inside bony capsules (bullae) in the pro-otics and (except in *Sprattus* and *Clupeonella*) also in the pterotic bones. A membrane within each pro-otic bulla separates gas (from the swimbladder) from perilymphatic liquid (surrounding the inner ear). This system, together with the head canal system and the *recessus lateralis*, probably monitors information necessary for schooling and other swimming activities, as also detection of predators and hazards.

(b) The small bones supporting the caudal fin have a characteristic arrangement and series of fusions between particular elements.

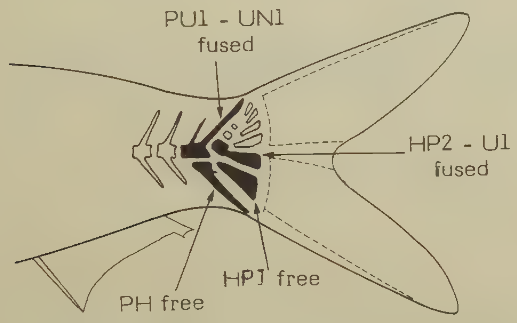
Most species of Clupeoidei are marine, coastal and schooling fishes, but some enter brackish- or freshwaters and some live permanently in freshwater (rivers or lakes). In this catalogue are given over 300 species of 80 genera, placed in 4 families; in most earlier literature the family Pristigasteridae is given as a subfamily of the Clupeidae, but recent work suggests that it is distinct (Grande, in press).


head canal
(with pore &
neuromast)
recessus
lateralis
utricular
macula
pro-otic bulla
endolymph
swimbladder
perilymph
pre-coelomic ducts

dorsal view (schematic) of connexions between swimbladder, inner ear and canals on head; black-gas; stippled- endo- and perilymph; wavy lines - water


utricular
maculae
endolymph
fenestra
elastic thread
perilymph
gas
pre-coelomic duct
from swimbladder
membrane of
pro-otic bulla

lateral view (cross-section) of connexion between pro-otic bulla (below) and inner ear (above); variations in gas pressure in the swimbladder are transmitted to the membrane of the pro-otic bulla; a fine elastic thread signals movements of the membrane to the inner ear


PU1 - UN1
fused
HP2 - U1
fused
HP1 free
PH free

typical clupeoid caudal fin skeleton; the first uroneural (UN1) and first pre-ural vertebra (PU1) are fused; the first of the six hypural plates (HP1) is free; the second (HP2) is fused at its base to the first ural vertebra (U1); and the hypural (PH) is free at its base

Key to the Clupeoid Families

1a. Articulation of lower jaw under or only just behind eye, lower jaw deep (Fig. 1)

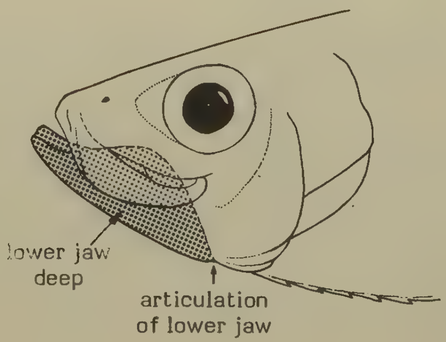
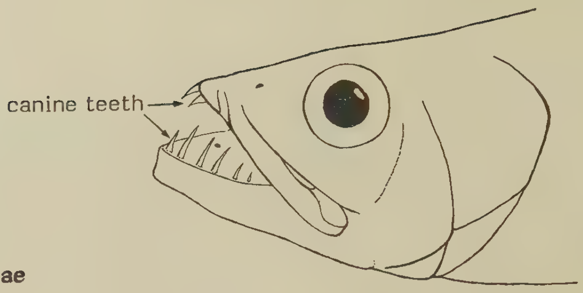

lower jaw
deep
articulation
of lower jaw

Fig. 1

2a. No scutes along belly (even pelvic scute absent); two fang-like canine teeth in upper jaw, pointing forward (Fig. 2); body highly compressed, elongate .... **Chirocentridae**

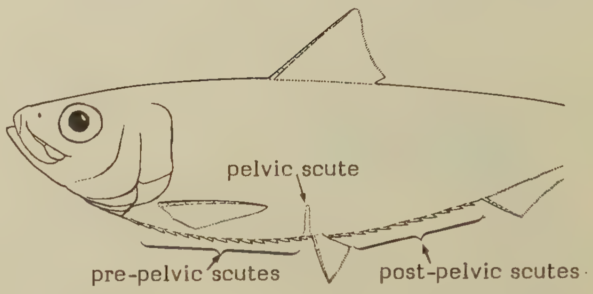


Chirocentridae Fig. 2

2b. Scutes usually present along belly (pelvic scute always present) (Fig. 3); canine teeth rare, never pointing directly forward in upper jaw; body usually oval or round in cross-section

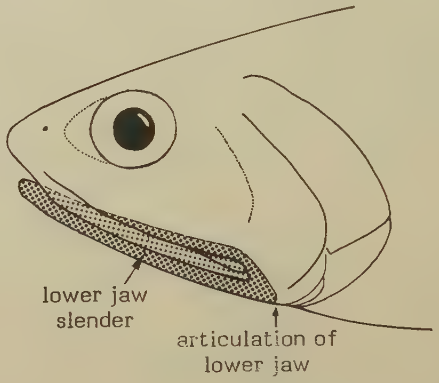
3a. Anal fin moderate, less than 30 finrays (unless mouth inferior, e.g. Dorosoma) .... **Clupeidae**

3b. Anal fin long, at least 30 finrays; lower jaw projecting, mouth directed more or less upward .... **Pristigasteridae**



Clupeidae, Pristigasteridae Fig. 3

1b. Articulation of lower jaw well behind eye, lower jaw usually slender (Fig. 4); snout 'pig-like' and projecting, lower jaw 'underslung' .... **Engraulididae**



Engraulidae Fig. 4

2.1 FAMILY CHIROCENTRIDAE

CHIROC

FAO Names : En - Wolf-herrings.

Diagnostic Features : Elongate, highly compressed, silvery fishes resembling the Clupeidae (herrings, sardines), but without scutes along the belly. Head strongly compressed, with two fang-like canine teeth pointing forward in the upper jaw, a series of canine teeth in lower jaw (larger at the front). Dorsal fin short, set well behind midpoint of body; pectoral fins set low; pelvic fins very small; anal fin longer than dorsal fin, beginning below about dorsal fin origin; caudal fin deeply forked. Scales numerous, small, usually lost; no lateral line down flank. Back bright blue (fading to grey), flanks bright silver.

Biology, Habitat and Distribution : Chirocentrids are marine coastal fishes widely distributed in the warmer parts of the Indo-Pacific region, from the western Indian Ocean (Red Sea, East Africa south to Durban) to the western Pacific (Japan, the Philippines south to northern Australia). They are pelagic inshore predators on small fishes and are said to exhibit a sort of feeding frenzy among small herrings and anchovies during night fishing with lights. Few studies have been made of breeding, but like most other clupeoids they probably scatter pelagic eggs from which planktonic larvae hatch. Among the largest of the clupeoids, they reach 100 cm standard length (Fowler, 1959:30, gave 3.66 m, but this is not correct; followed by Smith, 1953:87). If they are schooling fishes, then the schools are probably of moderate size (at least compared to schools of other clupeoids). No special fisheries exist and catches are small (50 083 tons in 1983).

A single genus, Chirocentrus, with 2 species.

Chirocentrus Cuvier, 1816

CHIROC Chiroc

Chirocentrus Cuvier, 1816, Règne animal, 1st ed., 2:178 (type: Clupea dorab Forsskål, 1775) (for correct dating of Cuvier, see Whitehead, 1967, emended by Cowan, 1969 to 7 December 1816).

Biology, Habitat and Distribution : See family.

Species : In the past, most workers have assumed a single species, C. dorab, occasionally with a second species C. hypselosoma. Whitehead, Boeseman & Wheeler (1966:27) showed that Bleeker's hypselosoma was C. dorab, while Luther (1968) resurrected an early Swainson name, nudus, for a second species in Indian waters. Although variations in body depth are not yet satisfactorily accounted for, modern works recognize two species:

C. dorab (Forsskål, 1775), Indo-West Pacific
C. nudus Swainson, 1839, Indo-West Pacific.

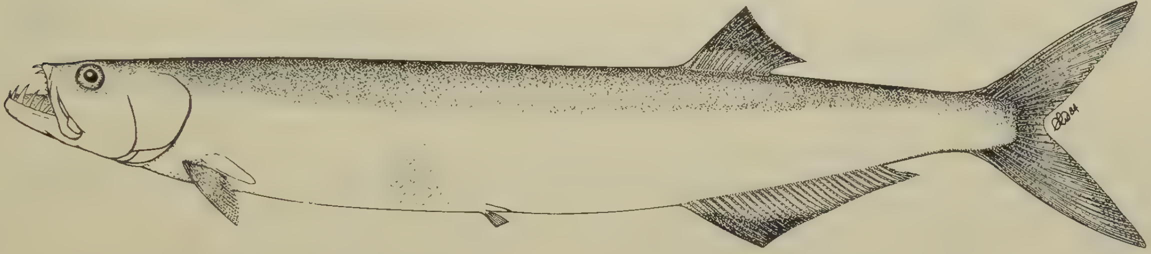
Chirocentrus dorab (Forsskål, 1775)

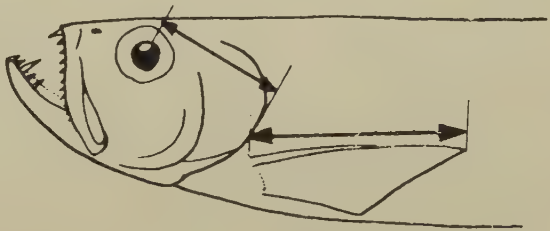
CHIROC Chiroc 1

Clupea dorab Forsskål, 1775, Descr.anim.:xiii, 7 (Djedda and Mocha, Red Sea).

Synonyms : Clupea dentex Schneider, 1801:428; Esox chirocentrus Lacepède, 1803:296; Chirocentrus hypselosoma Bleeker, 1852:71; Chirocentrus dorab - Whitehead et al., 1966:27 (Bleeker's C. hypselosoma); Luther, 1968:194; Whitehead, 1973b:167, fig. 2; SFSA, in press (southern Africa).

FAO Names : En - Dorab wolf-herring.





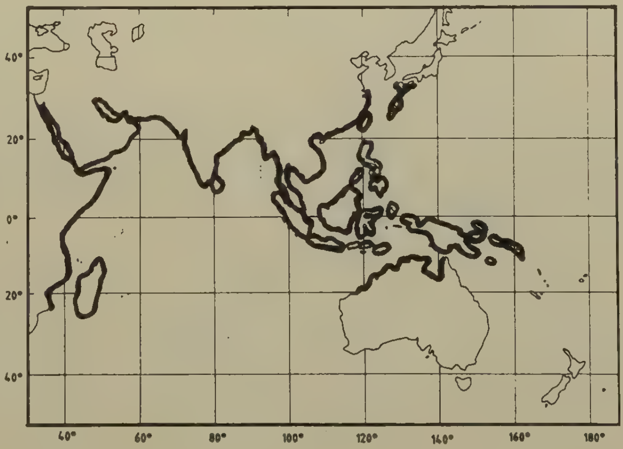
Diagnostic Features : The slightly shorter pectoral fin (11 to 13% of standard length; cf. 13 to 18%) and the black marking of the upper part of the dorsal fin are the only satisfactory characters separating this species from C. nudus; there is also some black on the anterior part of the anal fin. Variations in body depth may represent sexual dimorphism, but this needs study. See CHIROC Chiroc 1, Fishing Areas 57, 71 and also 51.

Geographical Distribution : Probably throughout the warmer coastal waters of the Indo-Pacific, from the Arab Gulf, Red Sea, east African coast south to Durban, eastward to Japan, the Philippines and south to northern Australia. However, it is not known to what extent C. nudus may contribute to these records.

Habitat and Biology : Pelagic, inshore fishes; feeding mainly on small fishes, but perhaps also crustaceans, etc.; no precise information on breeding.

Size : To about 100 cm of standard length.

Interest to Fisheries : Separate statistics for Chirocentrus (almost certainly including a proportion of C. nudus) are reported by Tanzania, Pakistan, India, Thailand, Indonesia, Malaysia, Singapore and the Philippines, with a total of 50 083 tons in 1983. The



catches in Palk Bay and around Rameswaram I in the Gulf of Mannar (southern India) are the only ones where the two species of *Chirocentrus* were positively separated (Luther, 1968); *C. dorab* contributed only 20% to the catch, the rest being *C. nudus*. Caught with gillnets, seines, shallow trawls and traps. Marketed fresh or frozen.

Local Names : INDIA: *Dorab*; Calcutta: Chela, Khanda, Samudrik; RED SEA: Dorab, Samak abu sayf.

Literature : Luther (1968 - separation of *C. dorab* from *C. nudus*); Whitehead (1973 - key to species, synonyms, references, fig.).

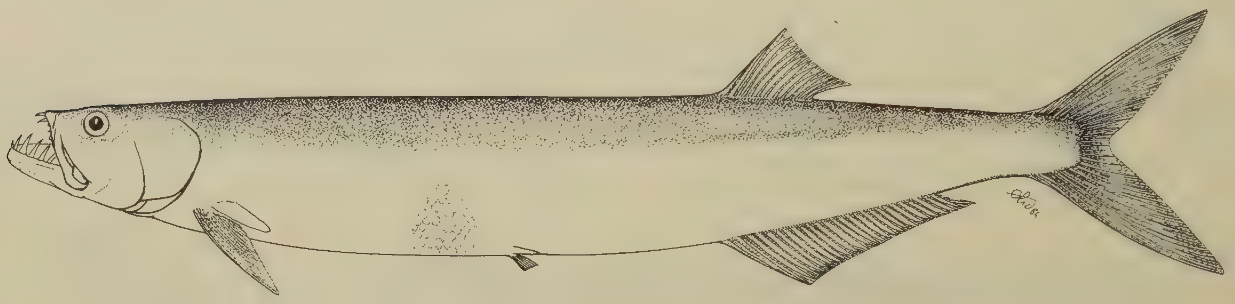
Chirocentrus nudus (Swainson, 1839)

CHIROC Chiroc 2

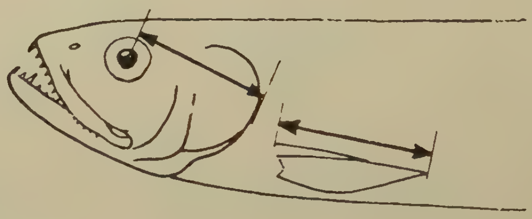
Chirocentrus russellii Swainson, 1838. *Nat.hist.anim.*, **1**:289 (on *Wallah* of Russell, 1803) (*nomen oblitum*).
Chirocentrus nudus Swainson, 1839, *Ibid*, **2**:294 (also on *Wallah*).

Synonyms : *Chirocentrus dorab* by many authors; *Chirocentrus nudus* - Luther, 1968:194; Whitehead, 1973b:168, fig. 3; Talwar, 1976:324.

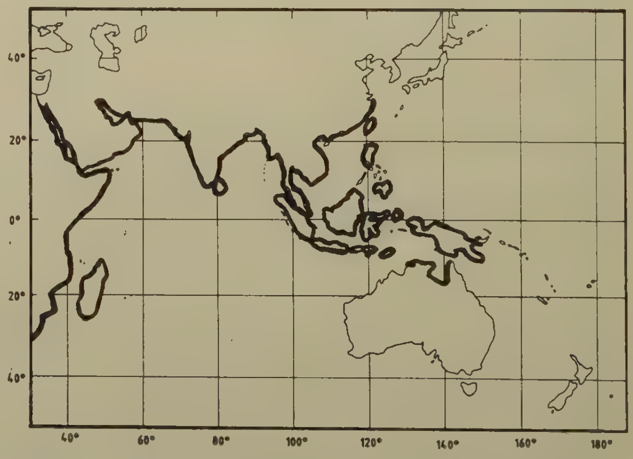
FAO Names : En - Whitefin wolf-herring.



Diagnostic Features : The slightly longer pectoral fin (13 to 18% of standard length; cf. 11 to 13%) and the absence of black markings on the dorsal fin tip are the only satisfactory characters separating this species from the otherwise virtually identical *C. dorab*; also, there is no black on the anterior part of the anal fin. Again, variations in body depth need more study. See CHIROC Chiroc 2, Fishing Areas 57, 71 and also 51.



Geographical Distribution : Probably similar to that of *C. dorab*, but not always distinguished from that species. Certain records are from Mombasa, the "Gulf", India (east and west coasts), Sri Lanka, the Indo-Australia archipelago and Canton.



Habitat and Biology : Apparently the same as for *C. dorab*.

Size : To about 100 cm standard length.

Interest to Fisheries : As for *C. dorab*. It is of interest that *C. nudus* predominated (80%) in the *Chirocentrus* catches of Palk Bay and the Gulf of Mannar (Luther, 1968), and comprised the total *Chirocentrus* catch off the Orissa coast (Talwar, 1976); in both cases these were gillnet fisheries.

Local Names : As for *C. dorab*.

Literature : Luther (1968 - separation from *C. dorab*); Whitehead (1973b - key to species, synonyms, references, fig.); Talwar (1976 - diagnosis).

2.2 FAMILY CLUPEIDAE

CLUP

FAO Names : En - Herrings, Sardines.

Diagnostic Features : Typically, clupeids are fusiform fishes, oval in cross-section, with a complete series of scutes along the belly (pelvic scute always present); the mouth is terminal, there are 2 supra-maxillae, and the jaw teeth are small or minute; the dorsal fin is short and near the midpoint of the body. The pelvic fins are just in front of, below or just behind the dorsal fin base, and the anal fin is short and its origin is well behind the last dorsal finray; the scales are adherent and of moderate size (about 40 to 50 in lateral series).

However, there is great variation in body shape and depth (round bodied to strongly compressed and deep), scutes (some or all absent along belly, but a few or a complete series of pre-dorsal scutes occasionally present), mouth shape (lower jaw prominent to mouth fully inferior in the gizzard shaps), supra-maxillae (one or both absent), teeth (absent in some, canines in others), and scales (deciduous in some, minute in others). The family as at present constituted is probably an artificial assemblage, being defined largely on the shared absence of those special characters that define the other clupeoid families.

Biology, Habitat and Distribution : Clupeids are typically marine coastal and schooling fishes found in all seas from 70°N to about 60°S, feeding on small planktonic animals (mainly crustaceans), forming large schools and scattering large numbers of pelagic eggs from which planktonic larvae hatch. Adults are usually 10 to 20 cm standard length. It is mainly the cool-water genera (*Clupea*, *Sardina*, *Sardinops*, *Sprattus*) that dominate the clupeoid catches.

As with morphology, so there is a great range in the biology and ecology of clupeids. Some enter freshwater to feed, some are anadromous (shads), and some live permanently in freshwater (West African pellonulines), some are partial or full-time filter-feeders (e.g. gizzard shads), some are predators on fishes (and probably form only loose and small schools as adults), and some produce only two hundred eggs or less (pygmy species) or attach their eggs to the substrate (*Clupea*). Great variation is found in size, from the shad *Tenualosa ilisha* (to about 60 cm) to certain pygmy riverine species which may be mature at under 2 cm (*Sierrathrissa*, *Thrattidion*, etc.).

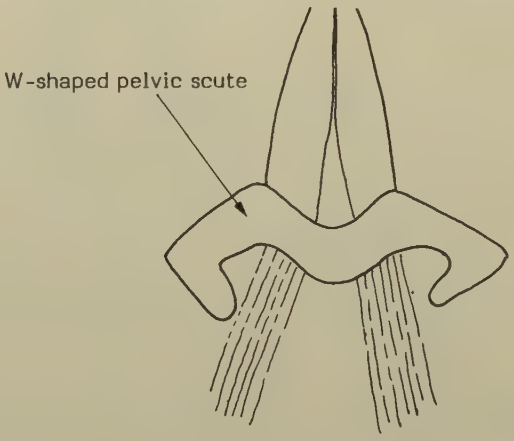
Interest to Fisheries : Individually, few of the warm-water species dominate clupeoid catches (exceptions are *Sardinella aurita*, *S. longiceps* and related species), but multi-species clupeid fisheries may account for as much as a third of the total fish catch in some areas.

Some 180 clupeid species are listed here, placed in 56 genera, but more species will probably be described; the true total may be close to two hundred, and the number of genera could rise to about sixty. The clupeids can be conveniently placed in 5 subfamilies, although work in progress will probably show that the present arrangement is artificial and does not reflect true relationships.

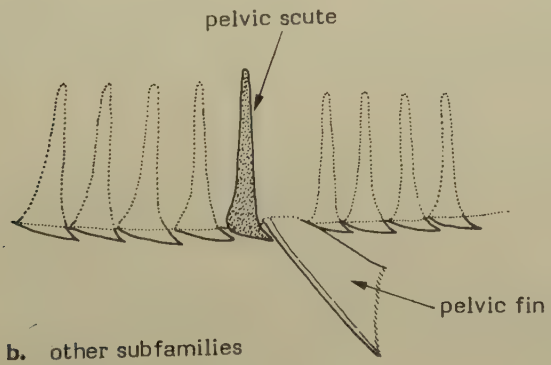
Key to the Clupeid Subfamilies

1a. Pelvic scute W-shaped (Fig. 1a); no other scutes along belly .... **Dussumieriinae**

1b. Pelvic scute with ascending arms (Fig. 1b); scutes usually present before and behind pelvic fins



a. Dussumieriinae



b. other subfamilies

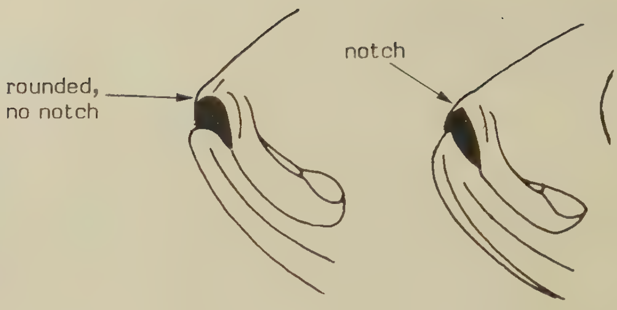
Fig. 1

2a. Upper jaw rounded when seen from front (Fig. 2a)

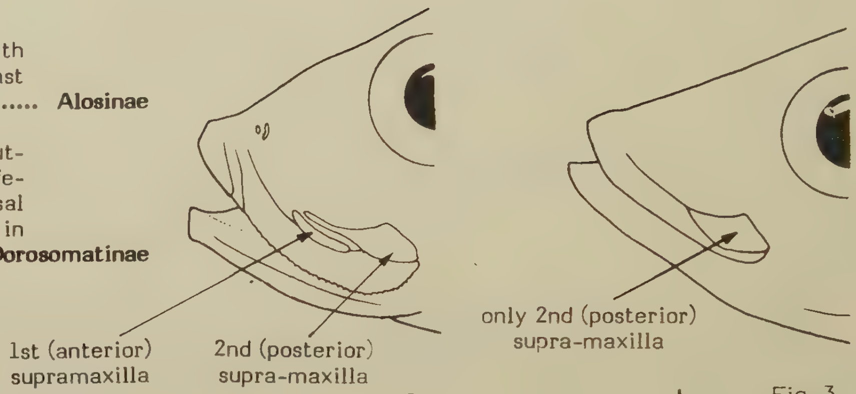
- 3a. Anterior as well as posterior supra-maxilla present (Fig. 3a); worldwide ... **Clupeinae**
- 3b. No anterior supra-maxilla (Fig. 3b); not in New World .... **Pellonulinae**

2b. Upper jaw with a distinct median notch or cleft when seen from front (Fig. 2b)

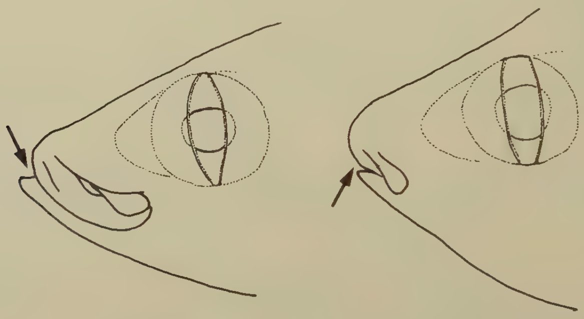
- 4a. Lower jaw normal, mouth terminal (Fig. 4a); last dorsal finray normal .... **Alosinae**
- 4b. Lower jaw flared outward, mouth usually inferior (Fig. 4b); last dorsal finray filamentous in many species .... **Dorosomatinae**



a. b. Fig.2)



a. b. Fig. 3



a. Alosinae b. Dorosomatinae Fig. 4

2.2.1 SUBFAMILY DUSSUMIERIINAE

FAO Names : En - Round herrings.

Diagnostic Features : Small or moderate-sized herring-like fishes immediately distinguished from all other clupeids by their W-shaped pelvic scute and absence of any other scutes (some pellonulines have only a few or no ventral scutes, but the pelvic scute always has lateral arms - see p.)

Biology, Habitat and Distribution : Round herrings are marine coastal and schooling fishes widely distributed in the Indo-Pacific region, from the western Indian Ocean (the "Gulf" to Cape Town) to the western Pacific (Japan to northern Australia, also Samoa); in the southern part of the eastern Atlantic (Cape Town north to Cunene River); in the western Atlantic (New York to Guyana); and in the eastern Pacific. They are pelagic inshore fishes, feeding mainly on zooplankton. Like other clupeoids, they scatter pelagic eggs from which planktonic larvae hatch. The largest round herrings (Etrumeus) reach 25 cm standard length; the smallest are mature at about 5 or 6 cm.

Interest to Fisheries : All are schooling fishes and thus exploited by fisheries, especially in Japan, South Africa and Indonesia. Recorded catches in 1983 were 150 578 tons.

Remarks : In earlier works, the round herrings have been placed in a separate family, Dussumieriidae (e.g. by Whitehead, 1963; given as Stolephoridae by Fowler, 1941:561). There are two pairs of genera, which can be placed in separate tribes, and 12 species.

Key to the Genera :

1a. Branchiostegal rays numerous (11 to 18) (Fig. 1); pre-maxillae rectangular (Fig. 2a) ....**Tribe Dussumieriini**

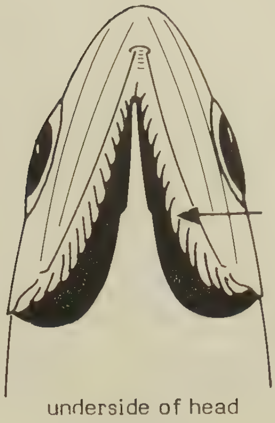
  2a. Pelvic fins under dorsal fin base; anal finrays 14 to 18; isthmus pointed anteriorly (Fig. 3a); Indo-Pacific only .... **Dussumieria**

  2b. Pelvic fins behind dorsal fin base; anal finrays 10 to 13; isthmus with 'shoulders' anteriorly (Fig. 3b); worldwide .... **Etrumeus**

1b. Branchiostegal rays few (6 or 7); pre-maxillae triangular (Fig. 2b) ....**Tribe Spratelloidini**

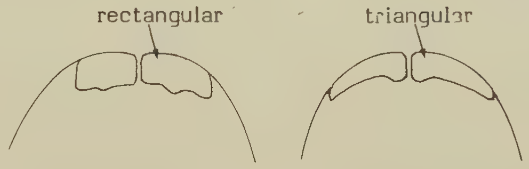
  3a. Indo-Pacific only; 2 supra-maxillae (Fig. 4a) ......**Spratelloides**

  3b. Western Atlantic only; 1 supra-maxilla (Fig. 4b) ....**Jenkinsia**


branchiostegal rays

underside of head
Tribe Dussumieriini

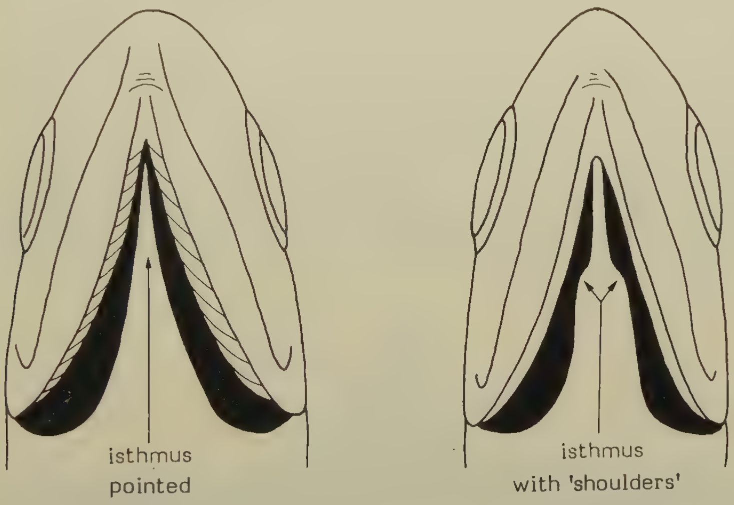
Fig. 1


rectangular
triangular

a. Tribe Dussumieriini b. Tribe Spratelloidini

pre-maxillae, seen from above

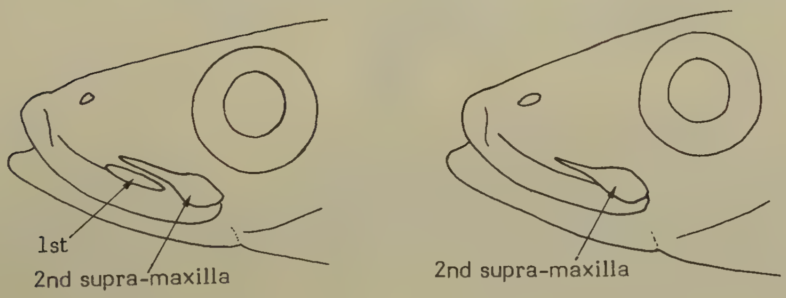
Fig. 2


isthmus
pointed
isthmus
with 'shoulders'

a. Dussumieria b. Etrumeus

underside of head

Fig. 3


1st
2nd supra-maxilla
2nd supra-maxilla

a. Spratelloides b. Jenkinsia

Fig. 4

Dussumieria Valenciennes, 1847

CLUP Duss

Dussumieria Valenciennes, 1847, *Hist.nat.poiss.*, **20**:647 (type: *Dussumieria acuta* Valenciennes, 1847). *Montalbania* Fowler, 1934, *Proc.Acad.nat.Sci.Philad.*, 85:224 (type: *Etrumeus (Montalbania) albulina* Fowler, 1934) (misspelt as *Montalbiana* by Bertin, 1943).

- **Synonyms :** None.

Diagnostic Features : Body slender, belly rounded, without pre- and post-pelvic scutes; the W-shaped pelvic scute, numerous branchiostegal rays (12 to 17) and rectangular pre-maxillae distinguish *Dussumieria* from all other clupeids except *Etrumeus*, which has fewer anal finrays, the pelvic fins less advanced and the isthmus (sternohyoideus muscle) with lateral flanges or 'shoulders' (see key).

Biology, Habitat and Distribution : Marine pelagic and schooling fishes of the Indo-Pacific region, from the western Indian Ocean (the "Gulf" to perhaps Madagascar) to the western Pacific (China to Papua New Guinea and Solomon Islands).

Interest to Fisheries : Contribute to general clupeoid catches, significantly so in Indonesia and the Philippines. The total catch in 1983 was 35 239 tons.

Species : Hitherto usually considered monotypic (Whitehead, 1963, 1973), but now known to include at least two species (Wongratana, 1980), whose ranges overlap in the "Gulf", around Indian coasts and Malaysia and Indonesia:

D. acuta Valenciennes, 1847, Indo-West Pacific
D. elopsoides Bleeker, 1849, Indo-West Pacific.

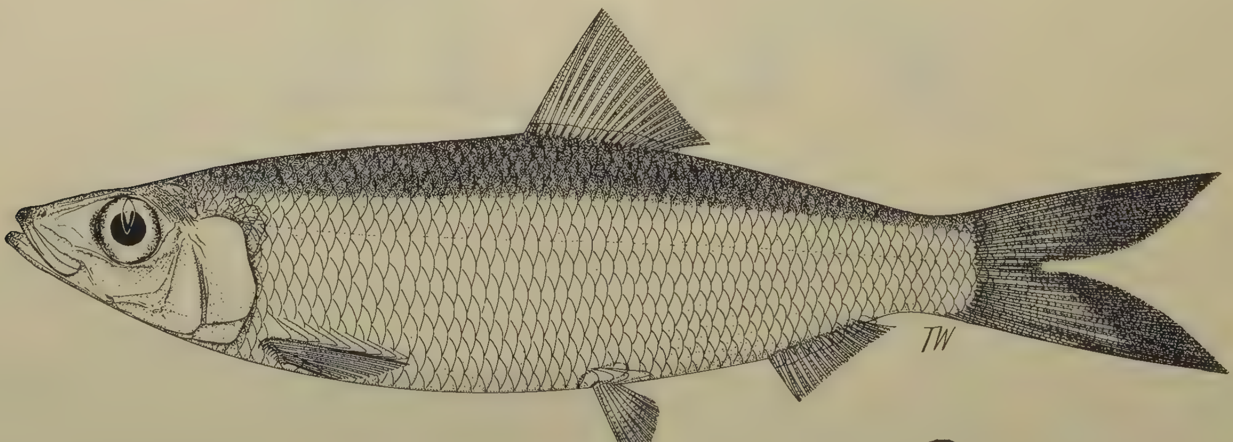
Dussumieria acuta Valenciennes, 1847

CLUP Duss 1

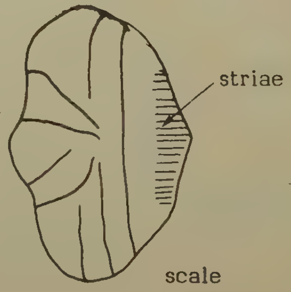
Dussumieria acuta Valenciennes, 1847, *Hist.nat.poiss.*, **20**:467 (Bombay, Coromandel).

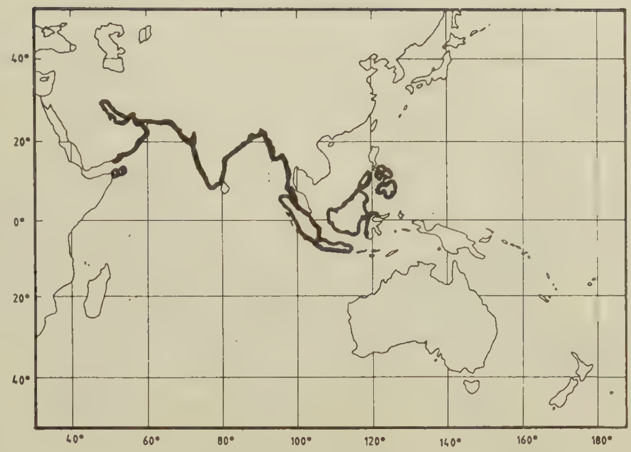
Synonyms : *Clupea flosmaris* Richardson, 1846:305 (suppressed); *Elops javanicus* Valenciennes, 1847:271; *Etrumeus (Montalbania) albulina* Fowler, 1934:244 (the Philippines); *Dussumieria acuta* - Whitehead, 1963:312, fig. 5; Whitehead 1973b:170, fig. 4; Wongratana, 1980:88, pls 11, 12 (revision).

FAO Names : En - Rainbow sardine.



Diagnostic Features : Closely resembles *D. elopsoides*, but body deeper (usually 22 to 29% of standard length), lower gillrakers fewer (19 to 26), branchiostegal rays fewer (12 to 15) and posterior part of scales marked with numerous tiny radiating striae. Black irridescent blue with a shiny gold/brass line below (quickly fading after death); hind margin of tail broadly dark. See CLUP Duss 1, Fishing Areas 57, 71 and also 51.





Geographical Distribution : Warmer waters of Indo-Pacific, from the "Gulf" (perhaps south to Somalia), along coasts of Pakistan, India and Malaysia to Indonesia (Kalimantan) and the Philippines. Earlier records included D. elopsoides.

Habitat and Biology : Marine, pelagic, mainly inshore fishes; studies on bionomics, general biology, food, breeding, eggs and larvae, juveniles, temperature tolerance of larvae, the gut and seasonal variations in fat content are listed by Whitehead (1973:171), but may equally have referred to D. elopsoides.

Size : To about 20 cm standard length.

Interest to Fisheries : Separate statistics only recorded from Hong Kong, Indonesia and the Philippines (the last two most likely with D. elopsoides also included). Good catches are made in Palk Bay and Gulf of Mannar (southern India) (Samuel, 1968). Caught will gillnets (rolavalai of southern India), also seines.

Local Names : INDIA: Rainbow sardine.

Literature : Whitehead (1963 - combined with D. elopsoides, however; 1973b - same); Wongratana (1980 - key, diagnosis).

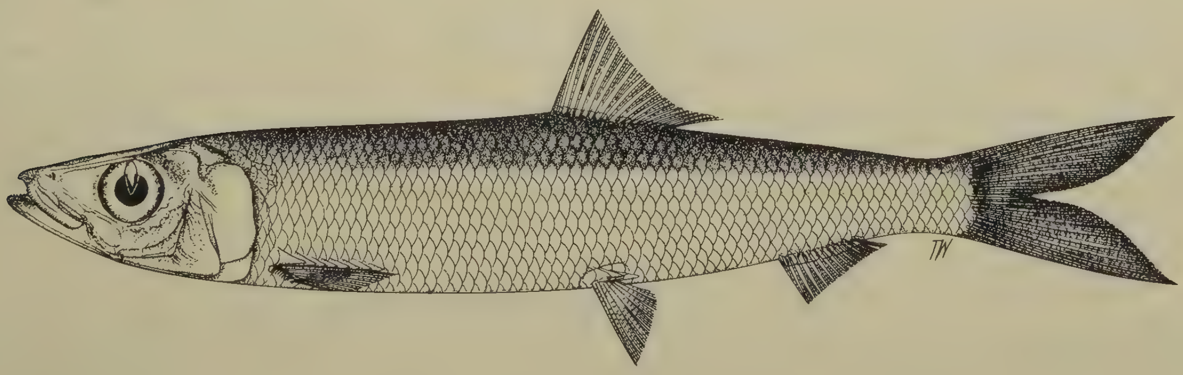
Dussumieria elopsoides Bleeker, 1849

CLUP Duss 2

Dussumieria elopsoides Bleeker, 1849, Verh.batav.Genoot.Kunst.Wet., **22**:12 (Madura Strait, Java Sea, etc.).

Synonyms : Dussumieria hasseltii Bleeker, 1850:422; Dussumieria productissima Chabanaud, 1933:4, figs 3-6 (Suez); Dussumieria acuta:CLOFNAM, 1973:110 (eastern Mediterranean); FNAM, 1984:275, fig. (same); Dussumieria elopsoides:Wongratana, 1980:85, pls 9, 10 (revision).

FAO Names : En - Slender rainbow sardine.



Diagnostic Features : More slender than D. acuta (depth usually 16 to 22% of standard length), lower gillrakers more (21 to 32), branchiostegal rays more (13 to 17) and no striae on posterior part of scales; colour apparently similar.

Geographical Distribution : From Suez and western Indian Ocean (the "Gulf" to Mombasa; possibly to Madagascar) along coasts of Pakistan, and India and Malaysia to western Pacific (China to about Solomon Islands). Immigrants in eastern Mediterranean (reported as D. acuta).

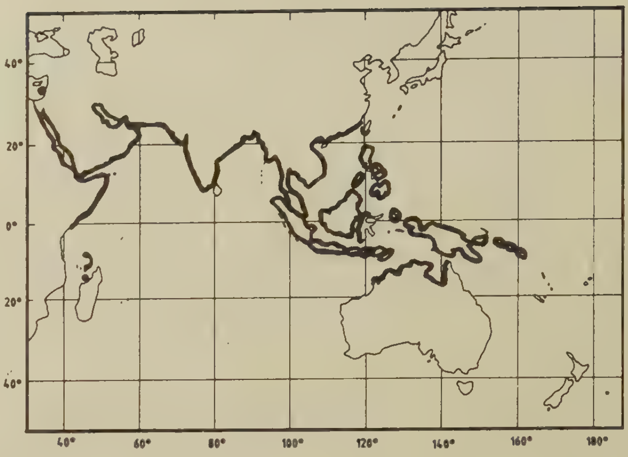
Habitat and Biology : Presumably similar to those of D. acuta, but the species not distinguished in earlier studies.

Size : To about 20 cm standard length.

Interest to Fisheries : Combined with data for D. acuta.

Local Names : As for D. acuta.

Literature : First properly separated from D. acuta by Wongratana (1980).



Remarks : Even more slender specimens (depth 16.7 to 17.2% of standard length) have been examined from Fiji which have a lower gillraker count of only 20 to 21 (cf. 21 to 23 in D. elopsoides). Possibly a third species is present.

Etrumeus Bleeker, 1853

CLUP Etru

Etrumeus Bleeker, 1853, Verh.batav.Genoot.Kunst.Wet., **25**:48 (type: Clupea micropus Schlegel, 1846). Perkinsia Eigenmann, 1891, Amer.Nat.Philad., **25**:153 (type: Perkinsia othonops Eigenmann, 1891). Halecula Jordan, 1925, Stanford Univ.Publ.Biol.Sci., **4**:41 (type: Halecula acuminata Jordan, 1925) (pre-occupied). Parahalecula Fowler, 1958, Notul.Naturae Philad., (310):5 (replacement for Halecula).

Diagnostic Features : Body slender, belly rounded, without pre- and post-pelvic scutes; the W-shaped pelvic scute, numerous branchiostegal rays (11 to 15) and rectangular pre-maxillae distinguish Etrumeus from all other clupeids except Dussumieria, which has more anal finrays, the pelvic fins more advanced and the isthmus (sternohyoideus muscle) tapering evenly forward (see key).

Biology, Habitat and Distribution : Marine pelagic and schooling fishes of both the New World (Atlantic and Pacific coasts) and the Indo-Pacific (absent between 25°N and 25°S, however); also, southern part of eastern Atlantic.

Interest to Fisheries : Of importance mainly off Japan and southern Africa, but a significant fishery also in the Red Sea. The total catch in 1983 was 110 084 tons.

Species : A single species recognized by Whitehead (1963), but a second species found by Wongratana (1983):

E. teres (De Kay, 1842), Indo-West Pacific, western Atlantic, eastern Pacific
E. whiteheadi Wongratana, 1983, southern Africa.

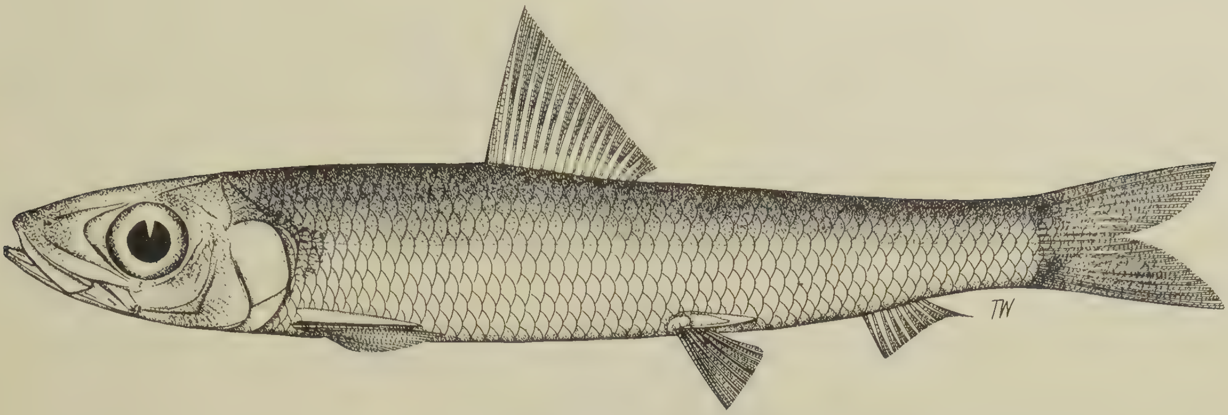
Etrumeus teres (De Kay, 1842)

CLUP Etru 1

Alosa teres De Kay, 1842, Nat.Hist.New York, pt. 4, Fishes:262 (New York region).

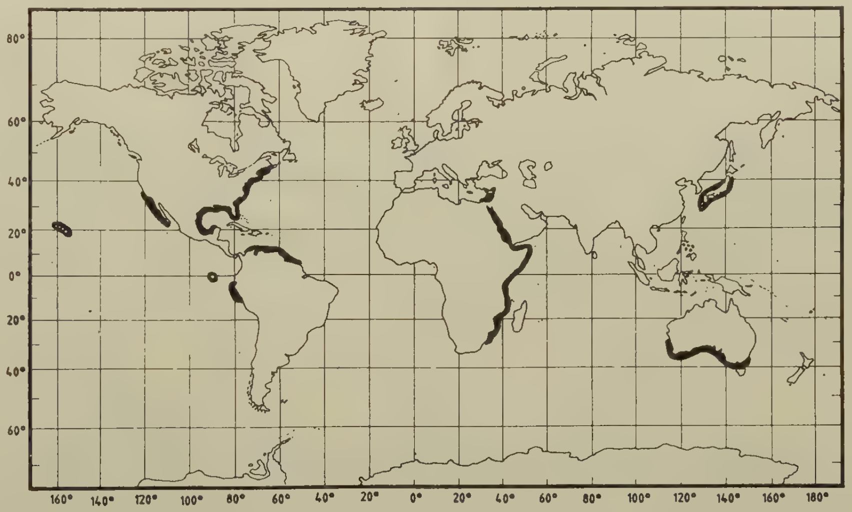
Synonyms : Clupea micropus Schlegel, 1846:236 (Japan); Etrumeus jacksoniensis Macleay, 1879:36 (Australia); Etrumeus acuminatus Gilbert, 1891:56 (eastern Pacific); Perkinsia othonops Eigenmann, 1891:153 (eastern Pacific); Etrumeus sadina:FWNA, 1964:263 (not Clupea sadina Mitchill, 1814, which was probably Sardinella aurita); Etrumeus teres - Whitehead, 1963:321, fig. 11; Chirichigno, 1968:399, fig. 7 (Lobos de Afuera Islands, Peru, about 6°30'S); Wongratana, 1980:83, pls 5, 6 (revision); SFSA, in press (southern Africa).

FAO Names : En - Red-eye round herring.



Diagnostic Features : See genus for main features. Some variation occurs in body depth and certain meristic characters (especially gillrakers), but ranges overlap between populations from widely separated regions (Whitehead, 1963). Distinguished from *E. whiteheadi* of southern African waters by having fewer lower gillrakers (30 to 35) and the pelvic fin base about 1/3 eye diameter behind base of last dorsal finray. See CLUP Etru 1, Fishing Area 51.

Geographical Distribution : Off southern African coasts (Mozambique to Durban, perhaps further south, but probably replaced by *E. whiteheadi* on western coast), western Indian Ocean (off Cape Gardefui, in Red Sea, with immigrants into the eastern Mediterranean), Japan and southern coasts of Australia; in western Atlantic (Bay of Fundy south to Florida, Gulf of Mexico, Venezuela and the Guianas); in eastern Pacific (California, Galapagos Islands, Hawaii, Peru at 6°30'S). The single eastern Mediterranean specimen reported by Ben-Tuvia (1963 - see also CLOFNAM, 1973:110) was probably *Spratelloides delicatulus*.



Habitat and Biology : Marine, pelagic, mainly inshore fishes; general biology in western Atlantic given by Hildebrand (1963:264-7) and in Australia by Blackburn (1941); data from southern Africa included *E. whiteheadi* also.

Size : To 25 cm standard length.

Interest to Fisheries : Separate statistics mainly reported from southern Africa and Japan (105 638 tons in 1983), but *E. whiteheadi* included in former. Caught mainly with purse seines.

Local Names : AUSTRALIA: Maray; JAPAN: Iwashi; PERU: Sardina redonda; SOUTH AFRICA: Rondeharing, Rooioog; USA: Atlantic round herring (eastern coast), Makiawa, Mikiawa, Omaka (Hawaii), Round herring (AFS list).

Literature : Whitehead (1963 - revision); Hildebrand (1964 - eastern coast of USA); Wongratana (1980 - Indo-Pacific).

Remarks : Electrophoretic studies on proteins may well point to differences between the various populations that will justify separation of subspecies or even species. If it is assumed that geographically isolated populations of *Sardinops* probably represent different species or subspecies, then the same is surely true of *Etrumeus*.

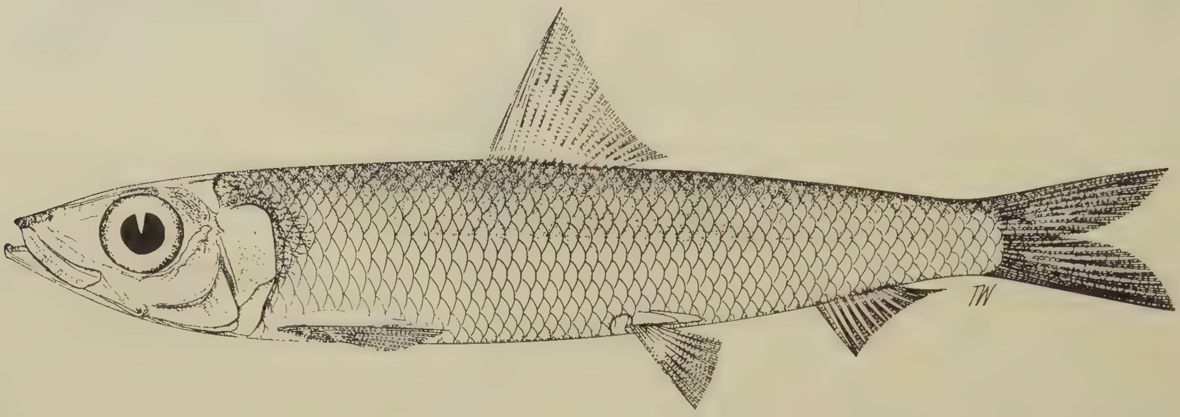
Etrumeus whiteheadi Wongratana, 1983

CLUP Etru 2

Etrumeus whiteheadi Wongratana, 1983, Jap.J.Ichthyol., **29**(4):387 (South Africa).

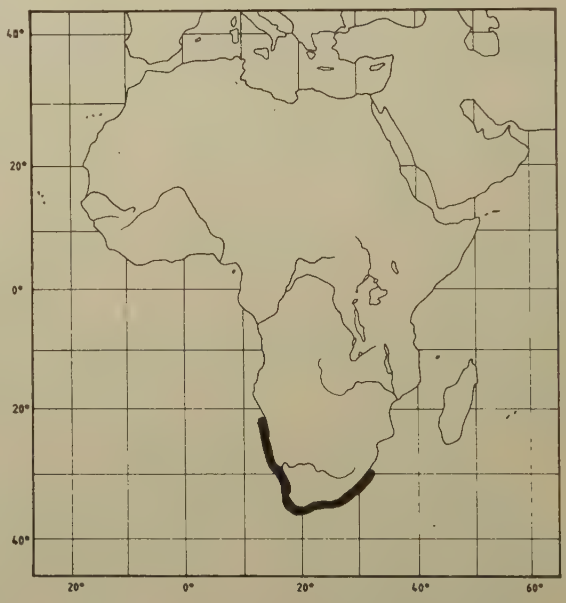
Synonyms : Etrumeus teres of authors on southern African specimens, especially on western coasts; Wongratana, 1980:84, pls 7, 8 (revision); SFSA, in press (southern Africa).

FAO Names : En - Whitehead's round herring.



Diagnostic Features : See genus for main features. Distinguished from E. teres in southern African waters by having more lower gillrakers (36 to 39) and the pelvic fin base below or just before base of last dorsal finray.

Geographical Distribution : Walvis Bay to Durban, possibly overlapping with E. teres from about Cape Town eastward.



Habitat and Biology : Marine pelagic, mainly inshore fishes; probably included in the data given for E. teres by workers in southern Africa.

Size : To 20 cm standard length.

Interest to Fisheries : Separate statistics for South Africa (63 009 tons in 1983) must refer largely to this species, although given as E. teres. Much smaller catches, also presumed to be this species, are reported by Namibia, and in earlier years by Poland and the German Democratic Republic working off this coast (6 653 tons in 1983).

Local Names : SOUTH AFRICA: Suidafrikaanse rondeharig.

Literature : Wongratana (1983 - key, diagnosis).

Remarks : Much more work is needed to determine the overlap of this species with E. teres in southern African waters and to explore possible differences in their biology.

Spratelloides Bleeker, 1851

CLUP Spratel

Spratelloides Bleeker, 1851, Natuurk.Tidschr.Ned.-Indië, **2**:214 (type: Clupea argyrotaeniata Bleeker, 1849 = S. gracilis). Stolephorus:Fowler, 1941, Bull.U.S.natn.Mus., 13(100):561 (not Stolephorus Lacepède, which is an anchovy).

Diagnostic Features: The W-shaped pelvic scute and few branchiostegal rays (6 or 7) distinguish Spratelloides from all other clupeids except Jenkinsia, which has only a single (posterior) supra-maxilla and does not occur in the Indo-Pacific region.

Biology, Habitat and Distribution: Small marine pelagic fishes of the Indo-Pacific region, from the western Indian Ocean (the "Gulf" south to about Durban) to the western Pacific (Japan south to northern and western Australia, also Samoa).

Interest to Fisheries: Contribute to general clupeoid catches, but separate statistics only given for around Japan (5 159 tons in 1983) and Fiji (96 tons in 1983).

Species: Whitehead (1963, 1973) recognized only two species, but Wongratana (1980, 1983) adds two more:

S. delicatulus (Bennett, 1831), Indo-West Pacific
S. gracilis (Temminck & Schlegel, 1846), Indo-West Pacific
S. lewisi Wongratana, 1983, Indo-West Pacific
S. robustus Ogilby, 1897, Indo-West Pacific.

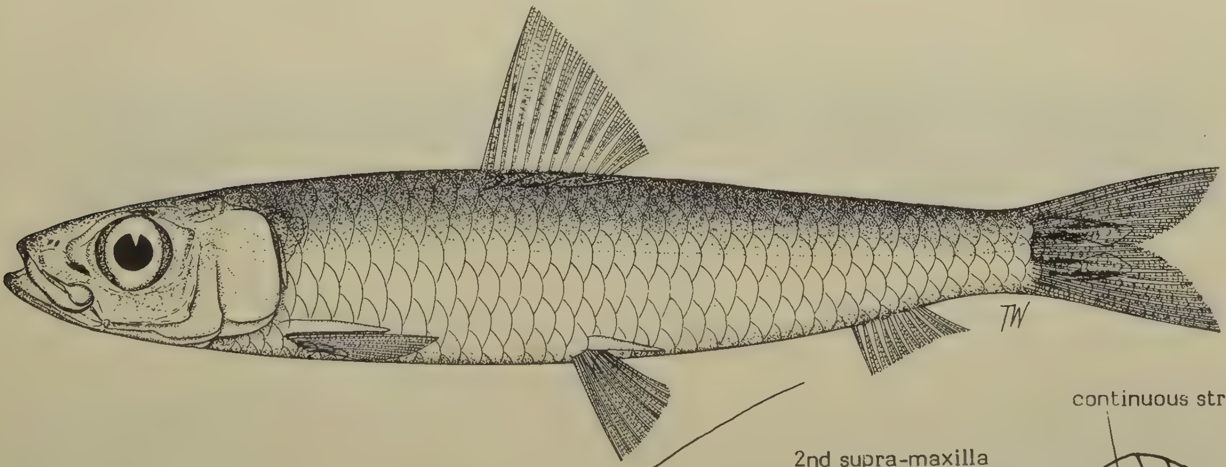
Spratelloides delicatulus (Bennett, 1831)

CLUP Spratel 1

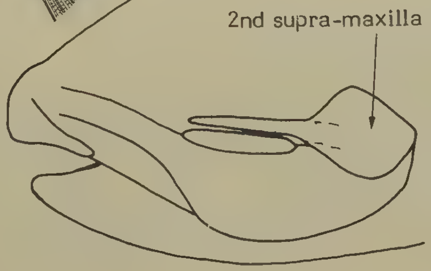
Clupea delicatula Bennett, 1831, Proc.zool.Soc.Lond., **1**:168 (Mauritius).

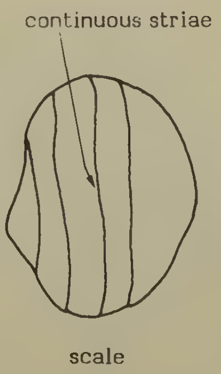
Synonyms: Clupea macassariensis Bleeker, 1849:72; Alausa alburnus Kner & Steindachner, 1866:387 (Valparaiso given, but in fact Samoa); Spratelloides delicatulus - Whitehead, 1963:345 (including S. robustus); Idem, 1973b:172, fig. 6 (same); FNAM, 1984:279, fig. (single eastern Mediterranean specimen; given as Etrumeus teres in CLOFNAM, 1973:110); Wongratana, 1980:105, pls 39, 40 (revision; S. robustus removed); SFSA, in press (southern Africa).

FAO Names: En - Delicate round herring.

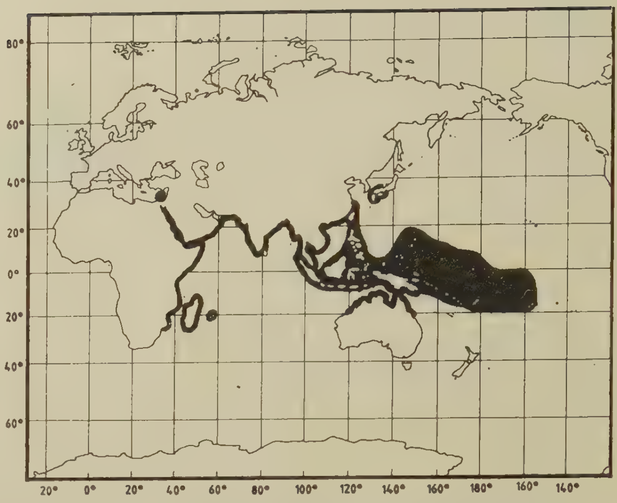


Diagnostic Features: No bright silver band along flanks, maxilla toothless, second supra-maxilla paddle-shaped and symmetrical, lower gillrakers 26 to 32, vertical striae on scales meeting at centre, posterior margin of scales smooth, pre-dorsal scales 8 to 13, and 35 to 41 scales in lateral series; two prominent dark streaks on caudal fin base. See CLUP Spratel 1, Fishing Area 51.





Geographical Distribution : Indo-Pacific, from western Indian Ocean (Red Sea south to Durban, also Madagascar and Mauritius) to western Pacific (Japan south through the Philippines to northern Australia, also eastward to Society Islands, but not Tuamotu and Marquesas Islands). A single specimen from eastern Mediterranean (Tel-Aviv, Israel).



Habitat and Biology : Marine pelagic and usually inshore schooling fishes. More data needed.

Size : To 7 cm standard length.

Interest to Fisheries : Separate statistics are not recorded, but probably makes a significant contribution to clupeoid fisheries. Used as a tuna baitfish in the Pacific.

Local Names : -

Literature : Whitehead (1963, 1973b - review); Wongratana (1980 - key, diagnosis); Lewis, Smith & Ellway (1983 - tuna baitfish).

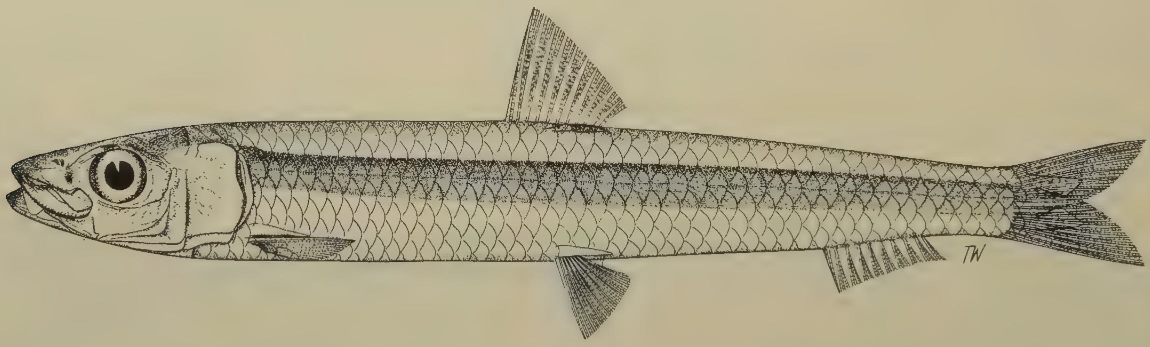
Spratelloides gracilis (Temminck & Schlegel, 1846)

CLUP Spratel 2

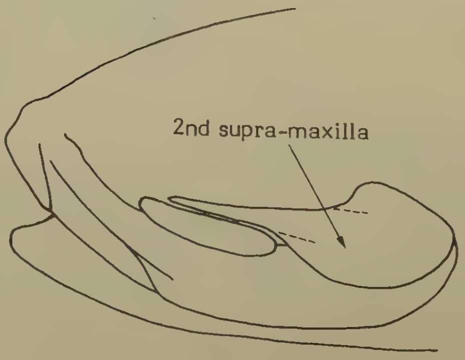
Clupea gracilis Temminck & Schlegel, 1846, Fauna Japonica, Poiss., pt. 5, inst. 13:238 (southern coast of Nagasaki).

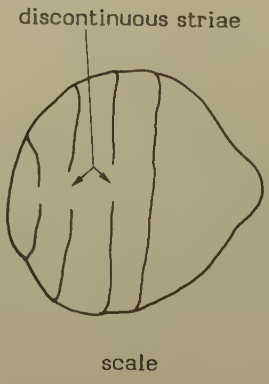
Synonyms : Clupea argyrotaeniata Bleeker, 1849:72; Spratelloides atrofasciatus Schultz, 1943:8; Stolephorus japonicus:Fowler, 1941:567 (not S. japonicus Lacepède, 1803, an anchovy); Spratelloides gracilis - Whitehead, 1963:338, fig. 18; Idem., 1973b:171, fig. 5; Wongratana, 1980:102, pls 35, 36 (revision).

FAO Names : En - Silver stripe round herring.

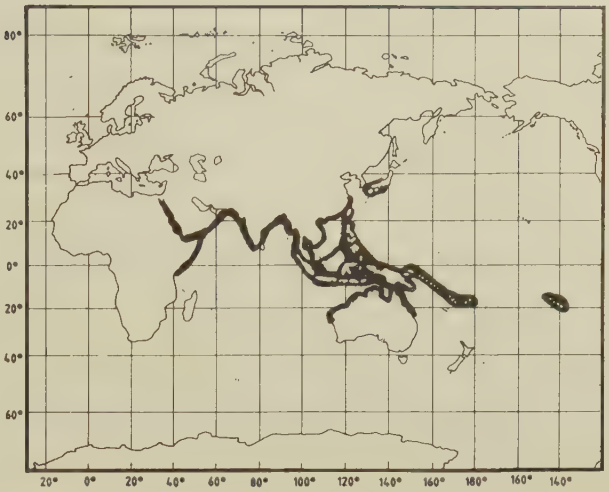


Diagnostic Features : Immediately distinguished from other species by the bright silver band along the flanks (a fainter band which fades anteriorly in S. lèwisi). Also, maxilla toothed, second supra-maxilla asymmetrical (lower part larger than upper), lower gillrakers very variable (27 to 37), vertical striae on scales not meeting at centre and 42 to 48 scales in lateral series. See CLUP Spratel 2, Fishing Area 51.





Geographical Distribution : Indo-Pacific, from western Indian Ocean (Red Sea south to Zanzibar) to western Pacific (Japan south through the Philippines to Samoa, not Cook, Society or Marquesas Islands, but reappears in the Tuamotu Islands, and southeastern Australia, also off western Australia).



Habitat and Biology : Marine, pelagic and usually inshore schooling fishes. More data needed.

Size : To 9.5 cm standard length.

Interest to Fisheries : Separate statistics only recorded for Fishing Areas 61 and 71 (5 255 tons in 1983, which may include other species), but probably contributes more to clupeoid catches than the records show. Used as a tuna baitfish in the Pacific.

Local Names : -

Literature : Whitehead (1963, 1973b - review); Wongratana (1980 - key, diagnosis); Lewis, Smith & Ellway (1983 - tunabait).

Remarks : Whitehead (1963, 1973b) considered the southern and western Australian form a subspecies, but Wongratana (1980) convincingly showed it to be a distinct species, *S. robustus*.

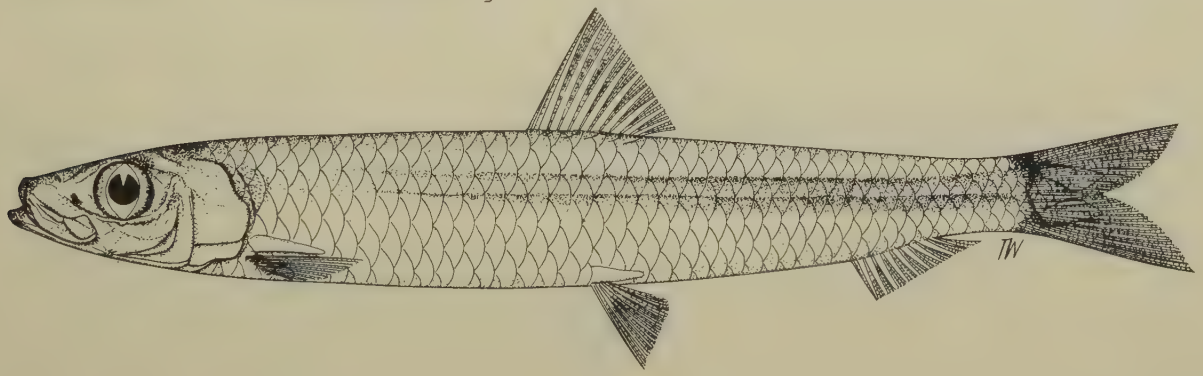
Spratelloides lewisi Wongratana, 1983

CLUP Spratel 3

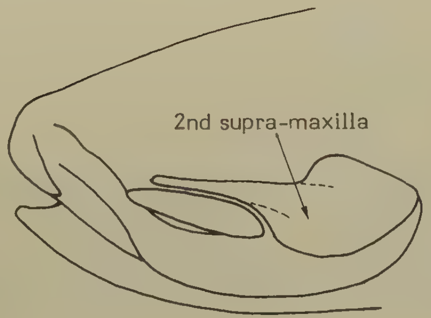
Spratelloides lewisi Wongratana, 1983, *Jap.J.Ichthyol.*, **29**(4):389 (Solomon Island, coasts of Papua New Guinea).

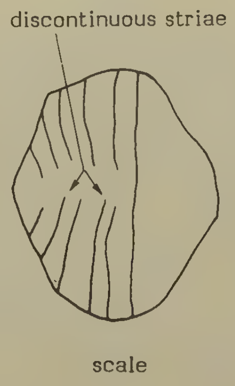
Synonyms : Probably included by authors in records of *S. gracilis* or *S. delicatulus* from the Papua New Guinea area; Wongratana, 1980:104, pls 37, 38 (revision).

FAO Names : En - Lewis' round herring.



Diagnostic Features : Distinguished from other species mainly by the silver band on the flanks which fades anteriorly (at about tips of pectoral fins). Also, maxilla toothed, second supra-maxilla asymmetrical (lower part larger than upper), lower gillrakers 28 to 32, vertical striae on scales not meeting at centre, and 39 to 43 scales in lateral series.





Geographical Distribution : Western Pacific (Solomon Islands, coasts of Papua New Guinea, off Irian Jaya).

Habitat and Biology : Marine, pelagic and usually inshore schooling fishes. More data needed.

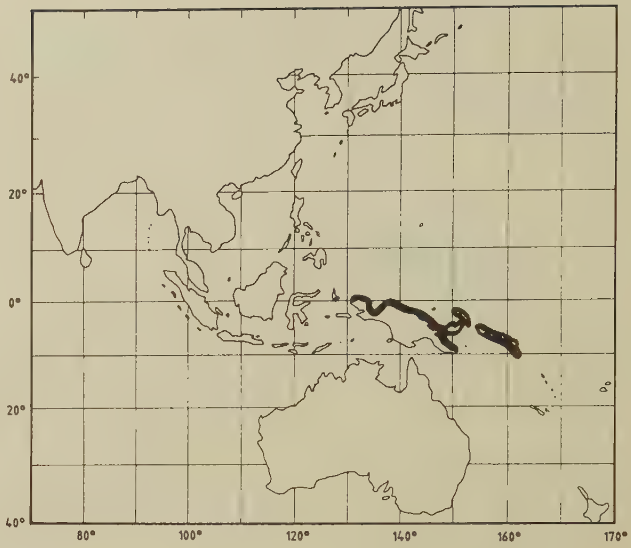
Size : To 6 cm standard length.

Interest to Fisheries : No separate statistics.

Local Names : -

Literature : Wongratana (1983 - key, diagnosis).

Remarks : The anterior fading of the silver lateral stripe along the flanks appears to be a good field character.



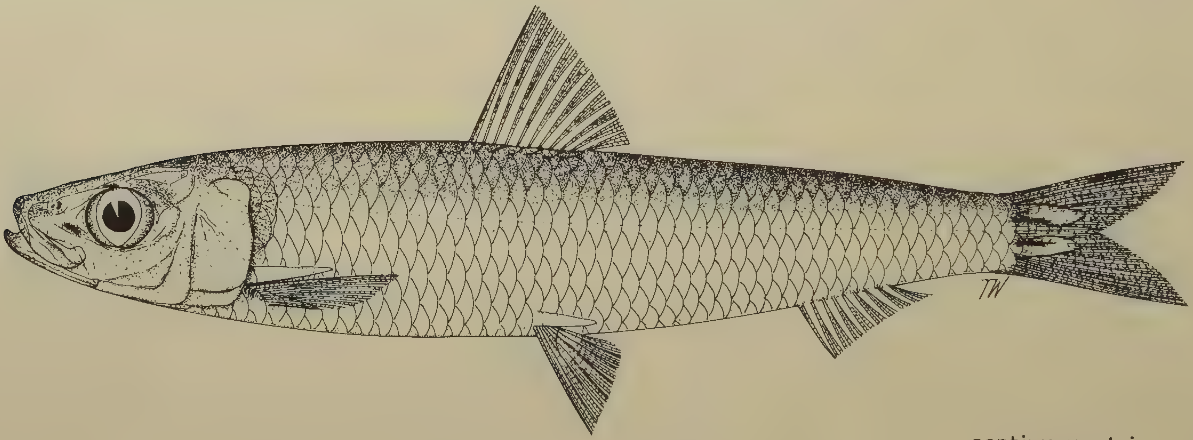
Spratelloides robustus Ogilby, 1897

CLUP Spratel 4

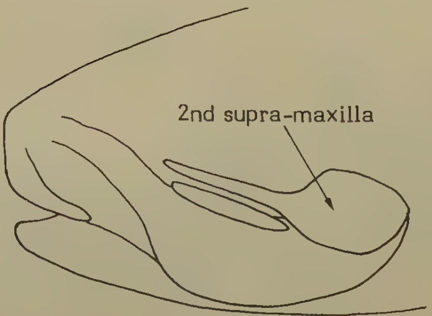
Spratelloides robustus Ogilby, 1897, Proc.Linn.Soc.N.S.W., **22**:64 (New South Wales).

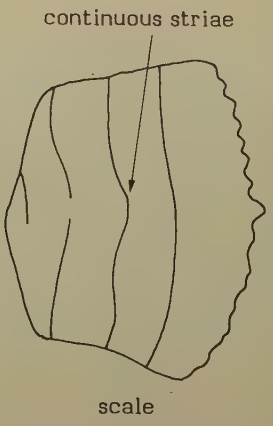
Synonyms : Spratelloides delicatulus robustus:Whitehead, 1963:348; Spratelloides robustus - Wongratana, 1980:108, pls 41, 42 (revision).

FAO Names : En - Fringe-scale round herring.

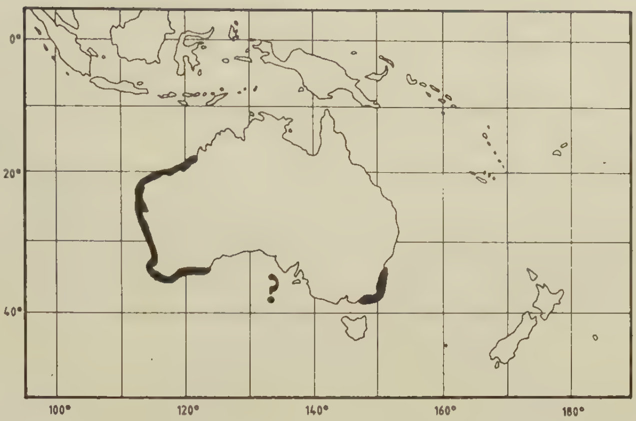


Diagnostic Features : Closely resembles S. delicatulus in lacking a silvery stripe along the flanks, no teeth on maxilla, second supra-maxilla symmetrical and scale striae meeting at centre; differs in having a toothed posterior margin to scales, pre-dorsal scales 13 to 16, and 42 to 46 scales in lateral series.





Geographical Distribution : Western Australia (Brenner Bank westward and northward to Dampier Archipelago), southeastern, Australia (southern parts of New South Wales).



Habitat and Biology : Marine, pelagic and usually inshore schooling fishes. More data needed.

Size : To 7.5 cm standard length.

Interest to Fisheries : Separate statistics not recorded, probably of little importance.

Local Names : -

Literature : Wongratana (1980 - key, diagnosis).

Remarks : Apparently overlaps with S. delicatulus along northwestern coast of Australia.

Jenkinsia Jordan & Evermann, 1896

CLUP Jenk

Jenkinsia Jordan & Evermann, 1896, Bull.U.S.natn.Mus., **50**:418 (type: Dussumieria stolifera Jordan & Gilbert, 1884).

Diagnostic Features : The W-shaped pelvic scute and few branchiostegal rays (6 or 7) distinguish Jenkinsia from all other clupeids except Spratelloides, which has two supra-maxillae (anterior missing in Jenkinsia) and is confined to the Indo-Pacific region.

Biology, Habitat and Distribution : Small, mainly coastal marine pelagic fishes of the western Atlantic (Florida south to Venezuela and the Guianas; also Bermuda).

Interest to Fisheries : No separate statistics; perhaps of small local interest.

Species : Hildebrand (1964:268, i.e. FWNA) recognized two species, the widespread J. lamprotaenia and the Bermudan J. viridis, the latter considered merely a synonym by Whitehead (1963:351), who described a second species, J. majua. Cervigón & Velasquez (1978) split J. lamprotaenia into three apparently distinct species, the other two being J. stolifera and J. parvula. Gillraker numbers suggest that the situation is more complex and can only be resolved using large collections throughout the Caribbean area. For the moment, four species can be recognized:

J. lamprotaenia (Gosse, 1851) western Atlantic
J. majua Whitehead, 1963, western Atlantic
J. parvula Cervigón & Velasquez, 1978, western Atlantic
J. stolifera (Jordan & Gilbert, 1884), western Atlantic.

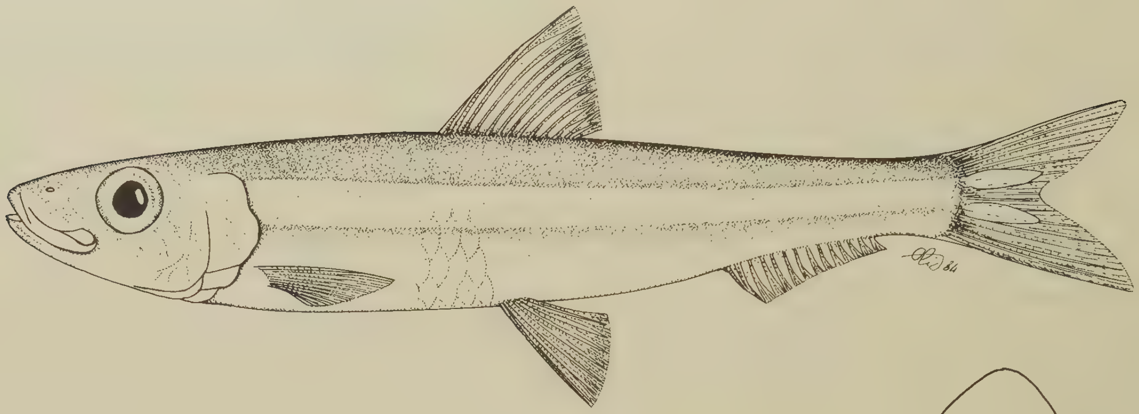
Jenkinsia lamprotaenia (Gosse, 1851)

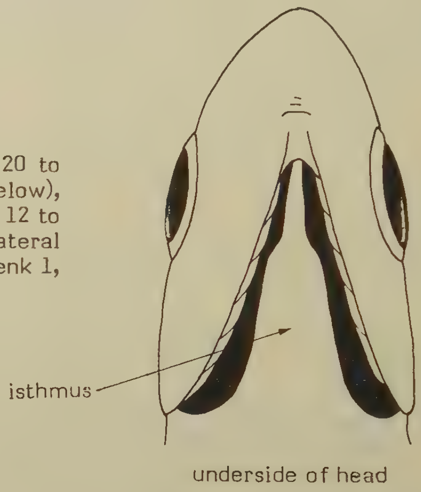
CLUP Jenk 1

Clupea lamprotaenia Gosse, 1851, Naturalist's sojurn in Jamaica:291 (Jamaica).

Synonyms : Stolephorus viridis Bean, 1912:122 (Bermuda); Jenkinsia bermudana Rivas, 1946:1 (viridis overlooked); Jenkinsia lamprotaenia - FWNA, 1964:268, fig. 64; Whitehead, 1963:351, fig. 23; Cervigón, 1966:116; Whitehead, 1973a:18, fig. 3; Cervigón & Velasquez, 1978:5, figs, 1-54 (descr., osteology).

FAO Names : En - Dwarf round herring (Dwarf herring in FAO Sheet, Area 31).





underside of head

Diagnostic Features : Pre-maxillae toothed, lower gillrakers 20 to 30, but some correlation with geographical area (see Remarks below), isthmus slender, but with slight 'shoulders' anteriorly, pectoral finrays 12 to 15 (usually 13), vertebrae 40 to 43 (usually 42 - Venezuela), silver lateral band not becoming narrower or fading near gill opening. See CLUP Jenk 1, Fishing Area 31.

Geographical Distribution : Western central Atlantic (Florida, Gulf of Mexico and Caribbean south to Tobago; also Bermuda).

Habitat and Biology : Marine pelagic and usually inshore schooling fishes, feeding on zooplankton.

Size : To 6.5 cm standard length.

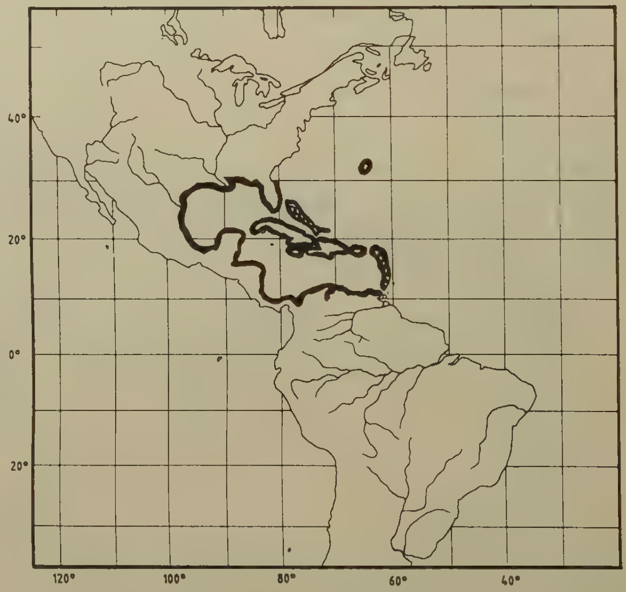
Interest to Fisheries : Separate statistics not recorded, probably of little importance.

Local Names : USA: Dwarf herring (AFS list); VENEZUELA: Canalera.

Literature : FWNA (1964 - key, diagnosis, biology); Whitehead (1963, 1973a - revision); Cervigón & Velasquez (1978 - osteology).

Remarks : Lower gillraker counts, although showing some overlap, show some correlation with geographical area, suggesting that the species may comprise three races or subspecies:

(a) gillrakers 20 to 26, usually 22 to 24; Mexico, Jamaica, Dry Tortugas, Bahamas, Virgin Islands, Martinique, Tobago;
(b) gillrakers 23 to 29, usually 24 to 27; Colombia, Venezuela;
(c) gillrakers 27 to 30, usually 29; Bermuda (viridis).



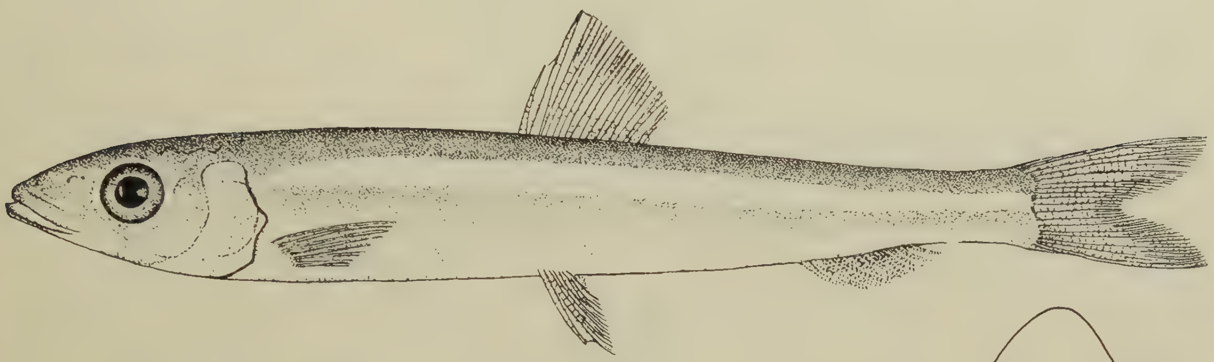
Jenkinsia majua Whitehead, 1963

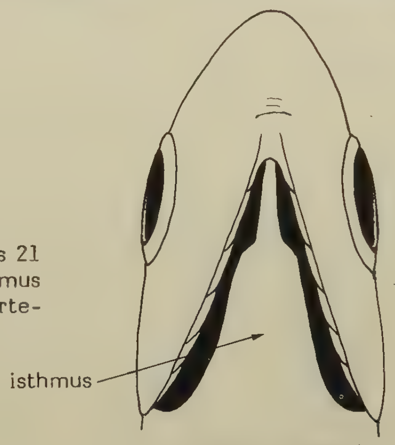
CLUP Jenk 2

Jenkinsia majua Whitehead, 1963, Bull.Br.Mus.nat.Hist.Zool., **10**(6):355 (Campeche Bank; Swan Island; Bahamas).

Synonyms : *Jenkinsia majua woodsi* Whitehead, 1963:356, fig. 24.

FAO Names : En - Little-eye round herring.

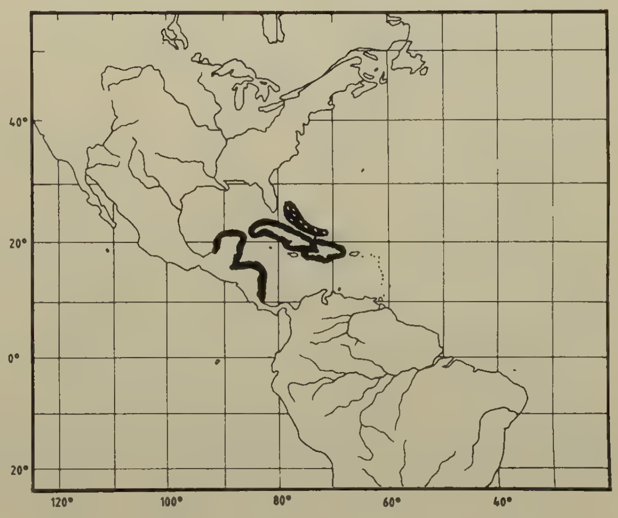




underside of head

Diagnostic Features : No teeth on pre-maxillae, lower gillrakers 21 to 28, but correlated with geographical area (see remarks below), isthmus with distinct blunt 'shoulders' anteriorly, pectoral finrays 12 to 14, vertebrae 38 (one fish), silver lateral band not fading away anteriorly.

Geographical Distribution : Western central Atlantic (Gulf of Campeche; Bahamas, northwestern coast of Caribbean).



Habitat and Biology : Marine, pelagic and usually inshore schooling fishes, feeding on zooplankton.

Size : To 5.5 cm standard length.

Interest to Fisheries : Separate statistics not recorded, probably of little importance.

Local Names : USA: Little-eye herring (AFS list).

Literature : Whitehead (1963 - key, revision).

Remarks : Two subspecies were recognized by Whitehead (1963:354), based on lower gillraker counts:

(a) *J. majua majua*: lower gillrakers 24 to 28 (mode 26); Gulf of Mexico.

(b) *J. majua woodsi*: lower gillrakers 21 to 24 (mode 23); Bahamas, northwestern Caribbean.

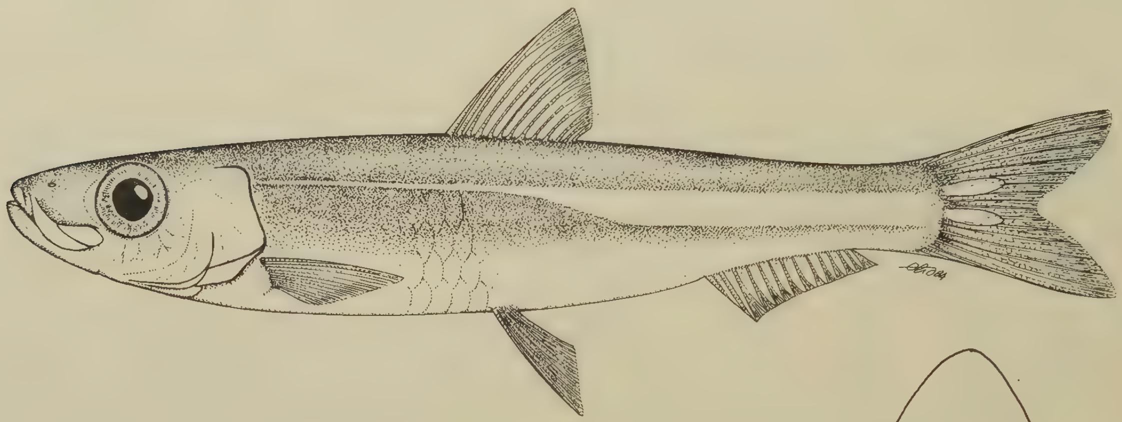
Jenkinsia parvula Cervigón & Velasquez, 1978

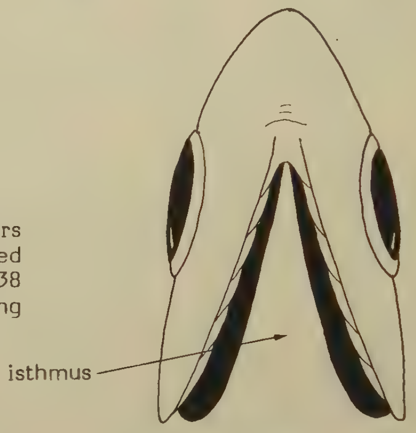
CLUP Jenk 3

Jenkinsia parvula Cervigón & Velasquez, 1978, Cuardern.oceanogr.Univ.de Oriente Venez., (7):9 (Venezuela).

Synonyms : Jenkinsia stolifera - Cervigón, 1966:925, fig. 376.

FAO Names : En - Short-striped round herring.





underside of head

Diagnostic Features : Pre-maxillae toothed, lower gillrakers 20 to 24 (usually 21 or 22), isthmus broadly triangular, pointed anteriorly, pectoral finrays 10 to 13 (usually 11 or 12), vertebrae 38 or 39 (usually 39), silver lateral band becoming narrower and fading anteriorly.

Geographical Distribution : Western central Atlantic (Venezuela).

Habitat and Biology : Marine, pelagic schooling near coral reefs, feeding on zooplankton.

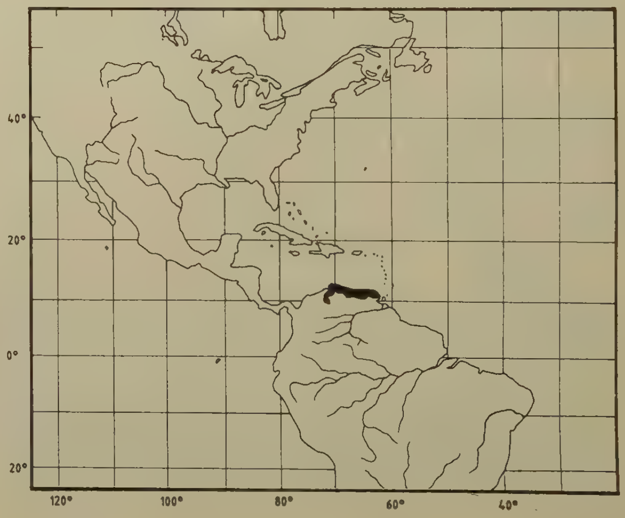
Size : To 5.5 cm standard length.

Interest to Fisheries : Separate statistics not recorded, probably of little importance.

Local Names : -

Literature : Cervigón & Velasquez (1978 - key, diagnosis).

Remarks : Specimens with the same characteristic anterior narrowing of the silver band on the flanks, but with a wide range of lower gillrakers (18 to 25), have been reported from Florida, the Bahamas, Jamaica, Serrana Bank and Puerto Rico (Whitehead, 1973a:20). More taxonomic work is needed.



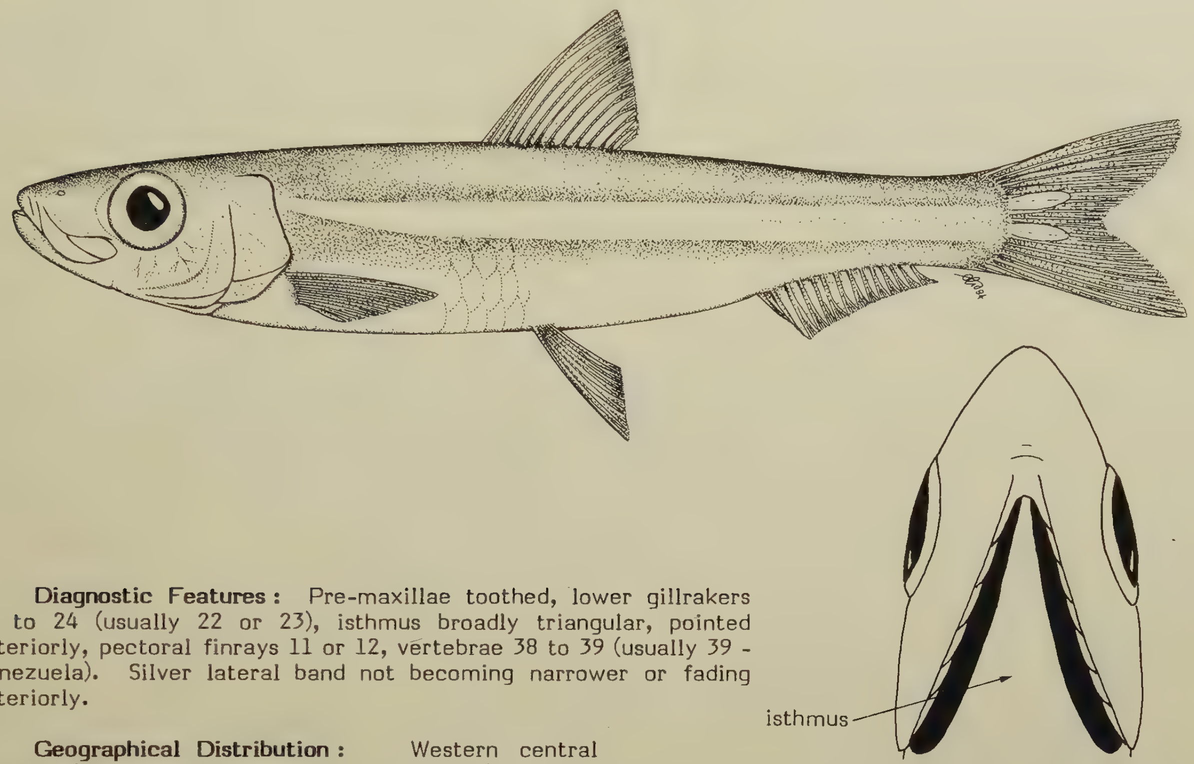
Jenkinsia stolifera (Jordan & Gilbert, 1884)

CLUP Jenk 4

Dussumieria stolifera Jordan & Gilbert, 1884, Bull.U.S.natn.Mus., **7**:25 (Key West, Florida).

Synonyms : Included in J. lamprotaenia in FWNA, 1964:271; Whitehead, 1963:351; Jenkinsia stolifera - Whitehead, 1973a:18 (key); Cervigón & Velazquez, 1978:9, 12 (Venezuela).

FAO Names : En - Florida round herring.



underside of head

Diagnostic Features : Pre-maxillae toothed, lower gillrakers 20 to 24 (usually 22 or 23), isthmus broadly triangular, pointed anteriorly, pectoral finrays 11 or 12, vertebrae 38 to 39 (usually 39 - Venezuela). Silver lateral band not becoming narrower or fading anteriorly.

Geographical Distribution : Western central Atlantic (Florida, British Honduras, Venezuela).

Habitat and Biology : Marine, pelagic and usually inshore schooling fishes, feeding on plankton.

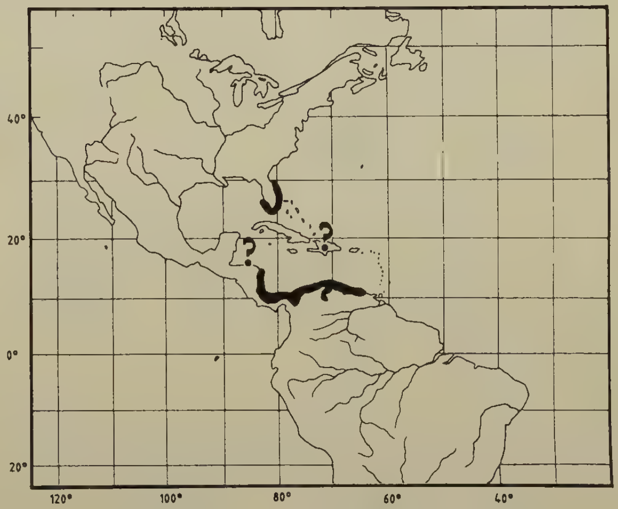
Size : To at least 4 cm standard length, probably to 5 or 6 cm.

Interest to Fisheries : Separate statistics not recorded, probably of little importance.

Local Names : USA: Shortband herring (AFS list).

Literature : Whitehead (1973a - key); Cervigón & Velazquez (1978 - key, diagnosis, on Venezuelan specimens only).

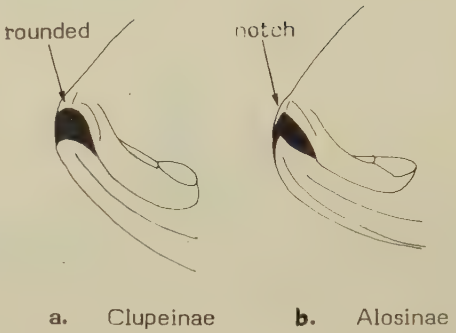
Remarks : The broadly triangular isthmus and the complete silver lateral band seem to characterize the species, but more taxonomic work is needed.



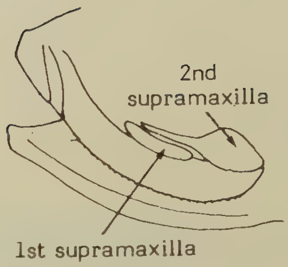
2.2.2 SUBFAMILY CLUPEINAE

FAO Names : En - Herrings, Sardines, Sprats.

Diagnostic Features : Small or moderate-sized herring-like fishes with a normal pelvic scute (i.e. with ascending arms) and scutes present before and behind the pelvic fins. Upper jaw rounded and not notched when seen from the front; two supramaxilla present, a usually elongate anterior and a paddle-shaped posterior; mouth terminal, lower jaw sometimes projecting slightly, teeth small, conical. Dorsal fin at about midpoint of body, short (13 to 21 finrays); anal fin short (12 to 23 finrays), its origin usually well behind the last dorsal finray; pelvic finrays 7 to 10 (mostly 7 or 8).



a. Clupeinae **b.** Alosinae



Biology, Habitat and Distribution : The Clupeinae are mainly marine coastal and schooling fishes, but some enter brackishwater and a few are confined to fresh- or brackishwater (Rhinosardinia, Platanichthys). They occur in the Indo-Pacific region, on both sides of the Atlantic and in the eastern Pacific. Most of the species are found in tropical or subtropical waters, but genera such as Clupea, Sprattus, Sardina and Sardinops occur in cool waters and high latitudes, extending the range of this subfamily to about 70°N and 55°S. These cool-water genera contribute to some of the most important of all clupeoid fisheries, but considerable tropical and subtropical catches come from species of Sardinella, Harengula, Herklotsichthys, etc.

There are 15 genera (4 worldwide, 6 New World, 3 Indo-Pacific, 2 European) and 72 species, thus the largest of the 5 subfamilies of Clupeidae.

Key to the Genera of Clupeinae :

1a. No bony capsule (bulla) in pterotic bone; pelvic finrays i 6 to i 7; temperate waters only

  2a. Last two anal rays normal, not enlarged; lower gillrakers 30 to 41; Europe, South America, Australasia .... **Sprattus**

  2b. Last two anal finrays enlarged (Fig. 1); lower gillrakers 39 to 67; Europe only ... **Clupeonella**

1b. Bony capsule (bulla) present in pterotic bone (Fig. 2)

  3a. Operculum with bony radiating striae (Fig. 3); last two anal finrays elongated; gillrakers absent on hind face of third epibranchial; fleshy 'rakers' on upper edge of ceratohyal (Fig. 4)

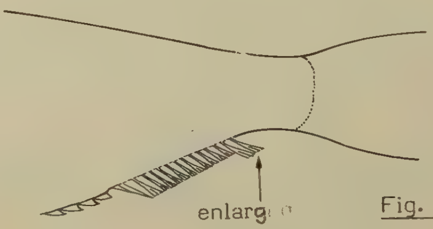
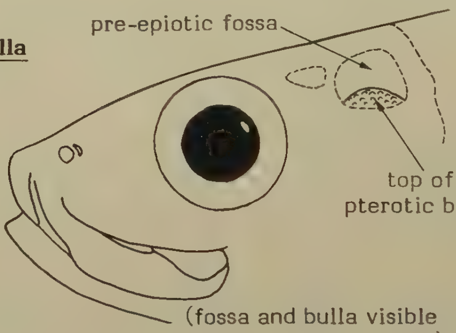


Fig. 1



(fossa and bulla visible when muscles removed)

Fig. 2

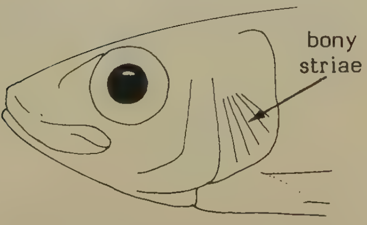


Fig. 3

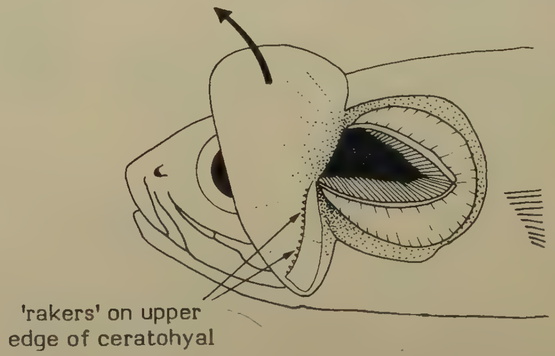


Fig. 4

4a. Scales on flank of uneven size; lower gillrakers not shortened at angle of first gill arch (Fig. 5a); maxilla not reaching to eye centre; eastern Atlantic, Mediterranean only ....**Sardina**

4b. Scales of equal size along flanks; lower gillrakers shortened at angle (Fig. 5b); maxilla reaching or almost reaching to eye centre; eastern N, S Pacific, southern Africa, Australia, New Zealand ....**Sardinops**

3b. Operculum smooth; gillrakers usually present on hind face of third epibranchial (Fig. 6); upper edge of ceratohyal smooth

5a. Hind border of gill opening with two distinct fleshy outgrowths (Fig. 7)

6a. Toothed hypo-maxillary bone between pre-maxilla tip and bulge of maxilla (Fig. 8); western Atlantic ....**Harengula**

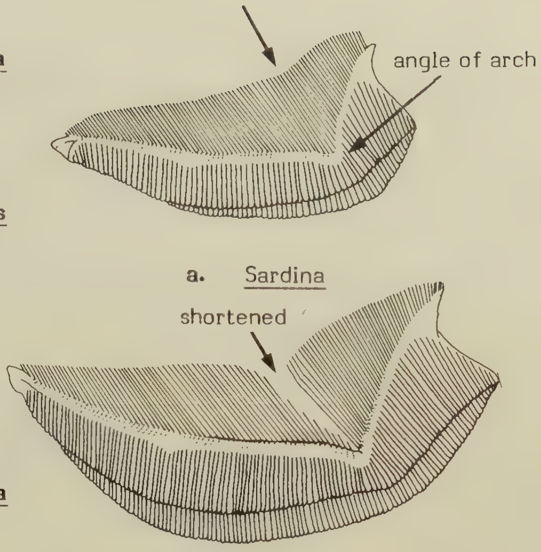
6b. No hypo-maxillary bone

7a. Last dorsal finray a long filament; western Atlantic, eastern Pacific ....**Opisthonema**

7b. Last dorsal finray normal; Indo-Pacific

8a. Fronto-parietal striae on top of head few, about 3 to 7 (Fig. 9a); lower part of second (posterior) supra-maxilla larger than upper (Fig. 10a); last two anal finrays not enlarged....... **Herklotsichthys**

8b. Fronto-parietal striae on top of head numerous, 7 to 14 (Fig. 9b); second supra-maxilla symmetrical (Fig. 10b); last two anal finrays enlarged


angle of arch
shortened

a. Sardina

b. Sardinops Fig. 5

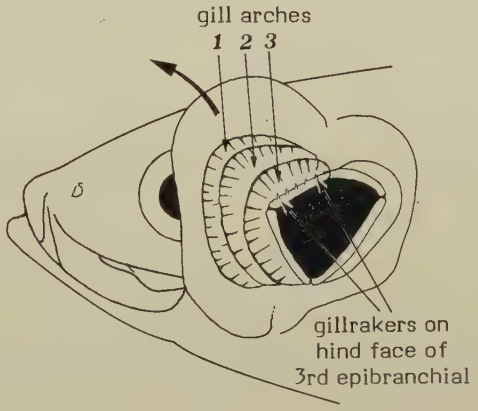

gill arches
1 2 3
gillrakers on hind face of 3rd epibranchial

Fig. 6

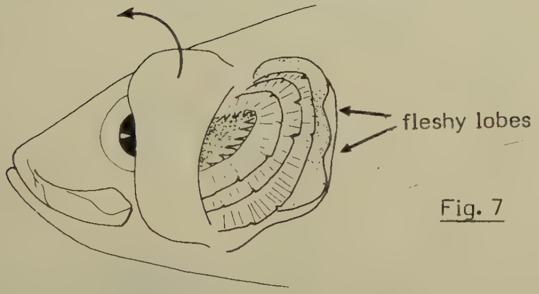
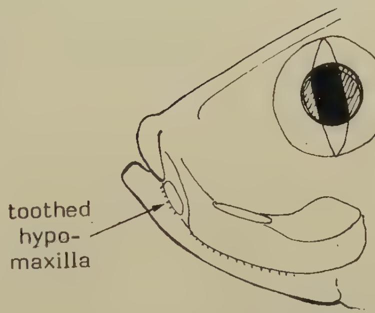
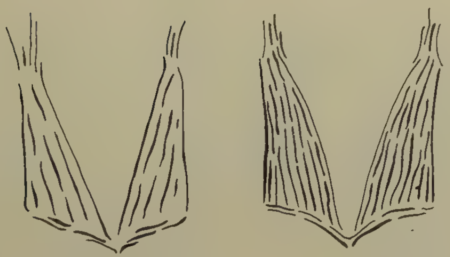

fleshy lobes

Fig. 7


toothed hypo-maxilla

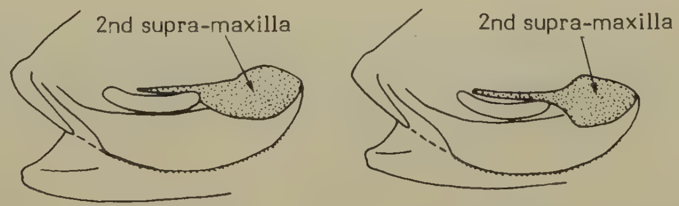
Harengula Fig. 8



a. Herklotsichthys b. Sardinella

fronto-parietal striae

Fig. 9


2nd supra-maxilla
2nd supra-maxilla

a. Herklotsichthys b. Sardinella Fig. 10

9a. Lower gillrakers 26 to 43; a median series of pre-dorsal scales (Fig. 11a) .... **Amblygaster**

9b. Lower gillrakers rarely less than 40 (mostly 45 to 90, but over 200 in some species); pre-dorsal scales usually paired (Fig. 11b) .... **Sardinella**

5b. Hind border of gill opening evenly rounded, without fleshy outgrowths

10a. Pelvic finrays i 8 (rarely i 7 or i 9); belly not sharply keeled; pelvic insertion behind dorsal fin origin; North Atlantic, North Pacific .... **Clupea**

10b. Pelvic finrays i 6 to i 7

11a. Indo-Pacific; pelvic finrays i 6; second supra-maxilla rectangular (Fig. 12) .... **Escualosa**

11b. New World only

12a. Pelvic finrays i 6

13a. Silver stripe along flanks; posterior frontal fontanelles retained in adults (Fig. 13) .... **Platanichthys**

13b. Flanks silver, no stripe; posterior frontal fontanelles occluded in adults .... **Ramnogaster**

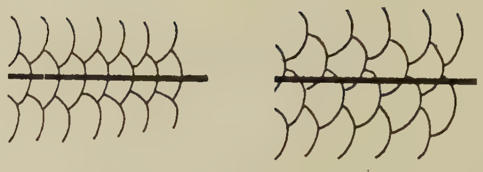
12b. Pelvic finrays i 7

14a. Sharp backward pointing spine near front of maxilla (Fig. 14) .... **Rhinosardinia**

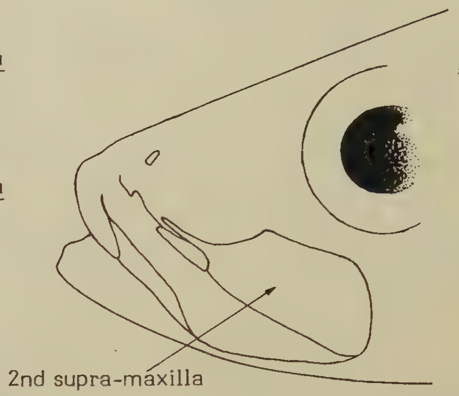
14b. No sharp spine on maxilla

15a. Silver stripe along flanks; eastern central Pacific, Caribbean and south to Brazil .... **Lile**

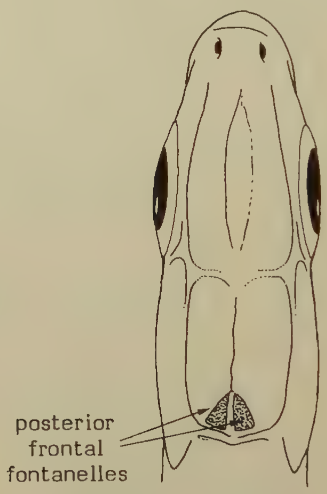
15b. Flanks silver, no stripe; southern tip of South America .... **Strangomera**


a. Amblygaster b. Sardinella

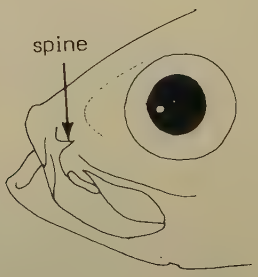
pre-dorsal scales Fig. 11



Escualosa Fig. 12



top of head
Platanichthys Fig. 13

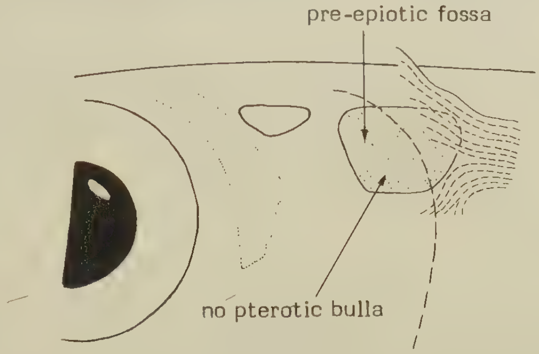


Rhinosardinia Fig. 14

Sprattus Girgensohn, 1846

CLUP Spratt

Sprattus Girgensohn, 1846, Mém.savants étrangers Acad.Sci.Pétersb., **5**:534 (type: Sprattus haleciformis Girgensohn, 1846). Spratella Valenciennes, 1847, Hist.nat.poiss., **20**:356 (type: Spratella pumila Valenciennes, 1846). Meletta Valenciennes, 1847, Hist.nat.poiss., **20**:366 (type: Meletta vulgaris Valenciennes, 1847). Maugeclupea Whitley, 1932, Rec.Austr.Mus., **18**:332 (type: Clupea bassensis McCulloch, 1911). Antu de Buen, 1958, Rev.Biol.mar.Valparaiso, **8**:87 (type: Clupea fuegensis Jenyns, 1846).



Diagnostic Features : Absence of a pterotic bulla (bony dome on floor of pre-epiotic fossa) distinguishes Sprattus from all other clupeine genera except Clupeonella (which has the pelvic fin origin distinctly behind the dorsal fin origin and has the last two anal finrays enlarged). From other Clupeinae that occur sympatrically, Sprattus differs in having only i 6 or 7 pelvic finrays (usually i 8 in Clupea), sharply keeled scutes (rather rounded in Strangomera) and no radiating bony striae on the operculum (Sardina, Sardinops). Apart from the absence of a pterotic bulla, however, Sprattus hardly differs from the South American Ramnogaster (Uruguay to Tierra del Fuego).

Biology, Habitat and Distribution : Marine pelagic and schooling fishes, especially of coastal waters, often close inshore; sometimes tolerating very low salinities; distribution essentially antitropical, occurring in the Northern Hemisphere (Europe) and the Southern Hemisphere (southern parts of South America and Australia, also in New Zealand).

Interest to Fisheries : Important fisheries in the North Sea, off Norway and in the Baltic (S. sprattus), but perhaps underexploited in the Southern Hemisphere.

Species : A single representative in the Northern Hemisphere (S. sprattus) and 4 in the Southern Hemisphere, the 2 New Zealand species only recently distinguished (Whitehead, Smith & Robertson, 1985):

S. antipodum (Hector, 1872), New Zealand
S. fuegensis (Jenyns, 1842), Southern South America
S. muelleri (Klunzinger, 1880), New Zealand
S. novaehollandiae (Valenciennes, 1847), Southern Australia
S. sprattus (Linnaeus, 1758) Northeast Atlantic, Mediterranean.

Remarks : Absence of a pterotic bulla can only be determined by dissection. Removal of the muscles near the corner of the operculum reveals a cavity, the pre-epiotic fossa. If the pterotic bulla is present, it appears as a rough-surfaced dome on the floor of the fossa.

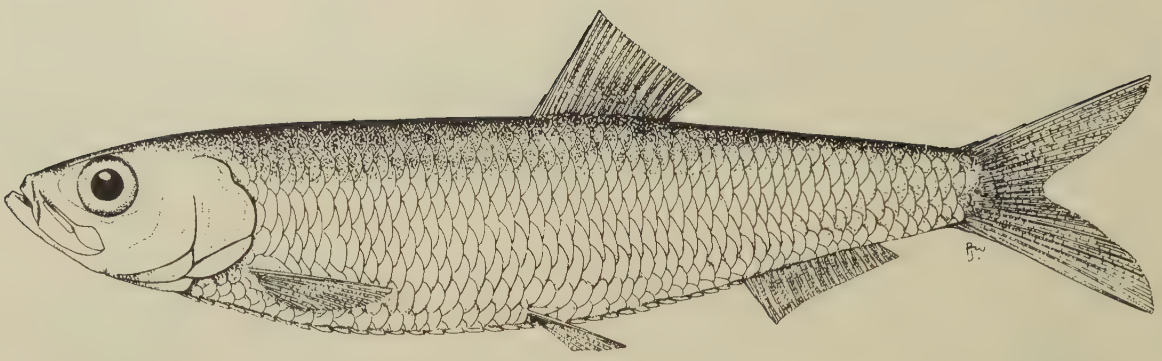
Sprattus antipodum (Hector, 1872)

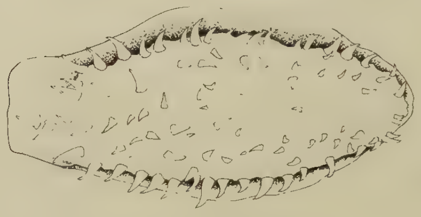
CLUP Spratt 4

Clupea sprattus var. antipodum Hector, 1872, Notes edib.fish. in Hutton, Cat.Fish.N.Z., Colon.Mus. & Geol. Surv.Dept., Publ. 18:133 (Foveaux Strait, New Zealand).

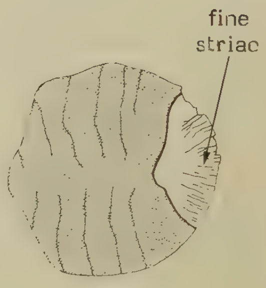
Synonyms : Clupea sprattus var. antipodarum:Colenso, 1879:572 (unjustified emendation); Clupea antipoda Hutton, 1904:51; Clupea holodon Regan, 1916:5 (Stewart I.); Clupea antipodum:Regan, 1917:227; Sprattus antipodum - Whitehead, Smith & Robertson, in press (key, diagnosis, biology, synopsis); name applied to S. muelleri in most literature.

FAO Names : En - New Zealand blueback sprat.





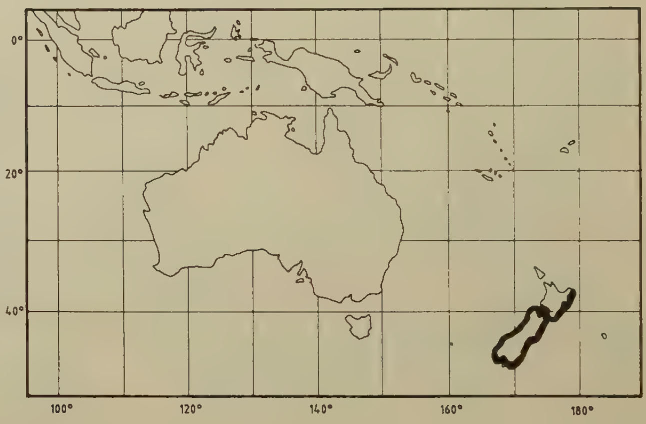
toothplate on tongue



scale

Diagnostic Features : Body slender, its depth 16 to 26% of standard length (mean 22%); gill cover without bony radiating striae; toothplate on tongue broad, almost oval, width about 3 times in length, lateral teeth strong; scales with fine radiating or horizontal striae on exposed posterior part; vertebrae 48 to 51; back steel blue when fresh.

Geographical Distribution : New Zealand coasts (east coast of the North Island, Cook Strait, apparently all coasts of the South Island south to Stewart Island and Foveaux Strait).



Habitat and Biology : Marine pelagic and schooling fishes of coastal waters; biology probably similar to that of S. muelleri, from which it has not usually been distinguished in earlier studies.

Size : To 12 cm standard length, usually 8 to 10 cm.

Interest to Fisheries : No separate statistics, but perhaps of local interest.

Local Names : -

Literature : Whitehead, Smith & Robertson (in press - synopsis).

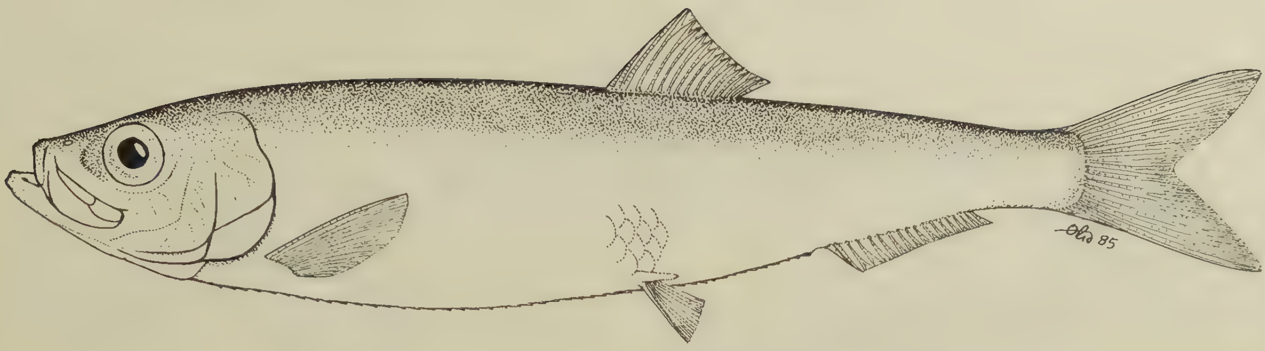
Sprattus fuegensis (Jenyns, 1842)

CLUP Spratt 2

Clupea fuegensis Jenyns, 1842, Zool.voy.Beagle, fishes:133 (Tierra del Fuego).

Synonyms : Clupea fuegensis:Regan, 1916:4; Norman, 1937:37, fig. 14 (Tierra del Fuego, Falklands/Malvinas); Fowler, 1945:1, fig (all records); Svetovidov, 1952:117; Idem, 1963:122; Clupea (Antu) fuegensis:de Buen, 1958:88; Sprattus fuegensis - Whitehead, 1964:326 (key).

FAO Names : En - Chilean sprat.



Diagnostic Features : Lower jaw slightly projecting, gill cover without bony radiating striae, teeth rarely present on vomer, or only 1 or 2; belly with strong keel of scutes; pelvic finrays i 7, insertion of fin under or just behind dorsal fin origin, last two anal finrays not enlarged. No dark spots on flanks.

Geographical Distribution : Western South Atlantic (from about 40°S to Tierra del Fuego, also Falklands/Malvinas); records from the Pacific coast (e.g. to Valparaiso, Chile, by Mann, 1954:130) may refer to *Strangomera*.

Habitat and Biology : Marine pelagic and schooling fishes of coastal waters. More data needed.

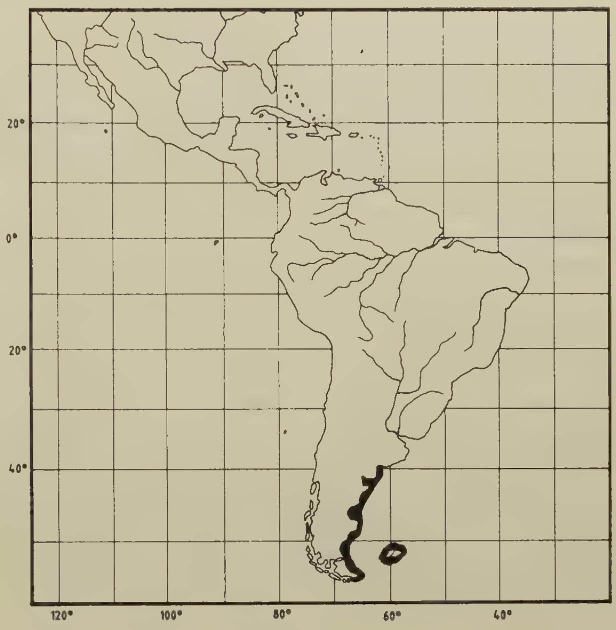
Size : To 18 cm standard length, usually to 15 cm.

Interest to Fisheries : Of perhaps considerable importance, but separate statistics not yet reported.

Local Names : CHILE: Pechu chalwa, Sardina quichay.

Literature : De Buen (1958 - synonymy only).

Remarks : Perhaps confused in the field with the possibly sympatric *Strangomera bentincki*, from which it can be distinguished by its more sharply keeled belly and fewer lower gillrakers (less than 50, cf. more than 60) which do not overlap the upper gillrakers.



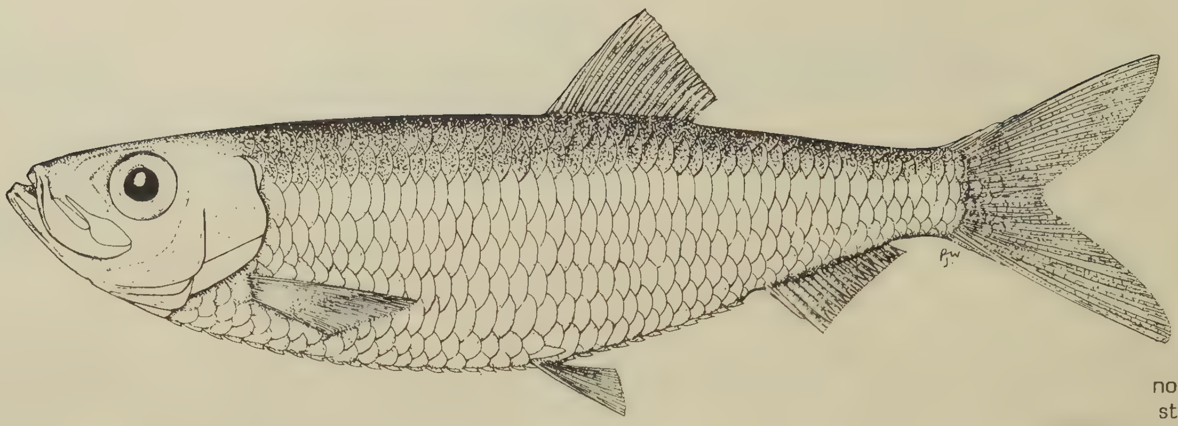
Sprattus muelleri (Klunzinger, 1880)

CLUP Spratt 5

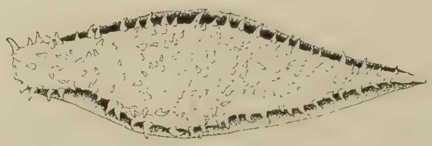
Clupea muelleri Klunzinger, 1880, *Sitzber.Akad.Wiss.Wien*, **80**(1):416 (New Zealand, Ferdinand von Müller collection).

Synonyms : *Clupea muelleri*:Regan, 1916:228; *Sprattus muelleri*:Whitehead, Smith & Robertson, in press (key, diagnosis, biology, synopsis); given as *S. antipodum* in most literature after Regan.

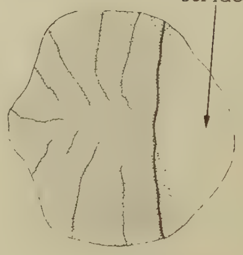
FAO Names : En - New Zealand sprat.



Diagnostic Features : Body moderately deep, its depth from 24 to 31% of standard length (mean 26%); gill cover without bony radiating striae; toothplate on tongue narrow, pointed at each end, its width about 4 or 5 times in length, lateral teeth moderate; scales without fine striae on exposed posterior part; vertebrae 43 to 47; back green/grey when fresh.

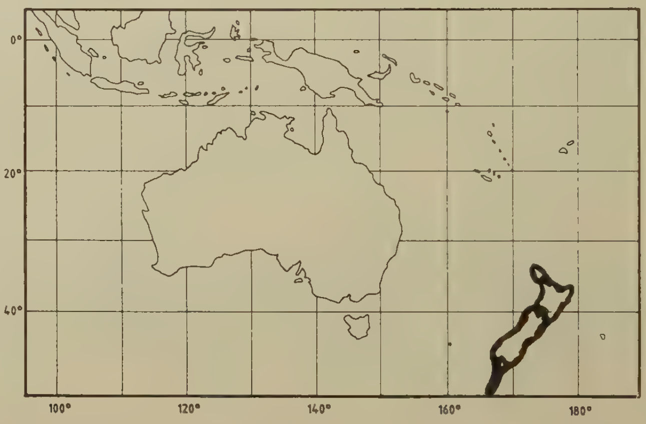


toothplate on tongue



scale

Geographical Distribution : New Zealand (eastern and western coasts of the North and the South Islands, possibly south to Foveaux Strait and even to Aukland Island, nearly 51^{o}S).



Habitat and Biology : Marine, pelagic and schooling fishes of coastal waters, from beaches down to 110 m or more. An apparently long spawning season (July to January) around the South Island, but not a fractional spawner; eggs present in mid-summer near Clutha River mouth (but samples may also have included S. antipodum). More data needed.

Size : To about 13 cm standard length, usually to 10 cm.

Interest to Fisheries : No separate statistics, but perhaps of local interest.

Local Names : -

Literature : Smith & Robertson (1981 - summary of breeding data); Whitehead, Smith & Robertson (in press - synopsis).

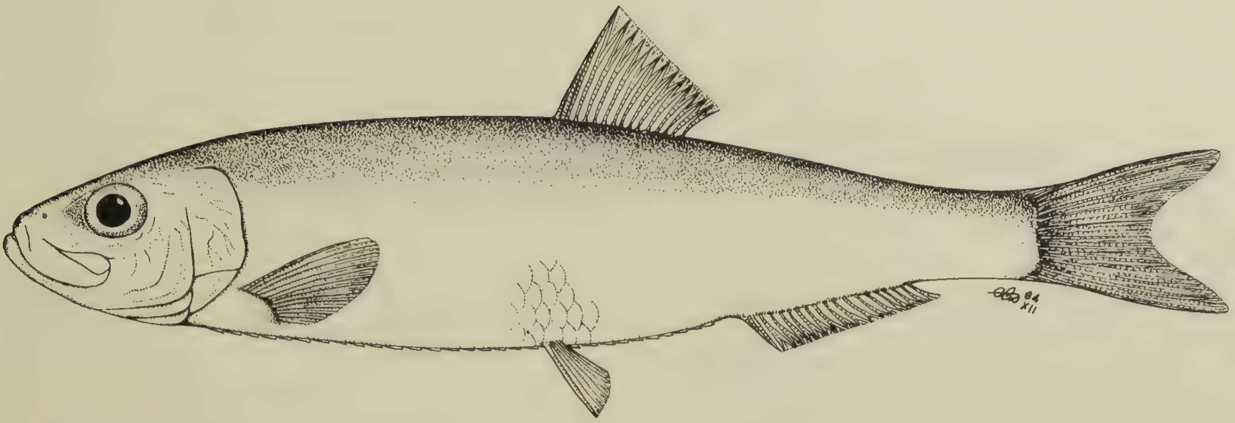
Sprattus novaehollandiae (Valenciennes, 1847)

CLUP Spratt 3

Meletta novae-hollandiae Valenciennes, 1847, Hist.nat.poiss., **20**:376 (Port Jackson, Australia).

Synonyms : Clupea (Pomolobus) bassensis McCulloch, 1911, Zool.Res.Endeavour, 1:16, pl. 4, fig. 2 (Bass Strait and Tasmania); Clupea bassensis:Regan, 1916:5; Munro, 1938:24, sp. 166; Sprattus bassensis Svetovidov, 1952:106; Idem, 1963:106 (in English); Sprattus novaehollandiae - Whitehead, 1967:21 (type); Idem, 1964:327 (key, synonymy).

FAO Names : En - Australian sprat.



Diagnostic Features: Lower jaw slightly projecting, gill cover without bony radiating striae, teeth absent on vomer; belly not sharply keeled, scutes rounded; pelvic finrays i 7, insertion of fin a little before dorsal fin origin, last two anal finrays not enlarged. Overlaps ranges of *Sardinops* (series of spots along flank, bony striae on gill cover) and *Hyperlophus* (scutes present on back before dorsal fin).

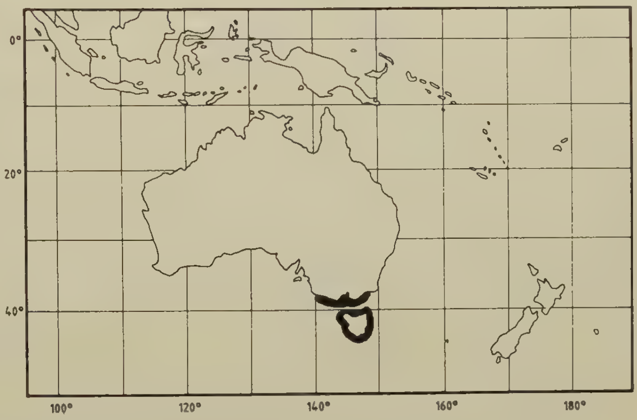
Geographical Distribution: Tasmania, Bass Strait, southeastern Australia north to Sydney.

Habitat and Biology: Marine pelagic and schooling fishes of coastal waters, appearing off Tasmanian shores in large schools (especially in August-November) and often entering estuaries (e.g. of Tamar and Derwent rivers; said to ascend the former as far as Launceston in March *fide* Blackburn, 1941). More data needed.

Size: To about 14 cm standard length.

Interest to Fisheries: No separate statistics, but schools seasonally large.

Local Names: AUSTRALIA: Sprat (Tasmania).



Literature: Blackburn (1941 - as *Clupea bassensis*, taxonomy, biology summarized briefly).

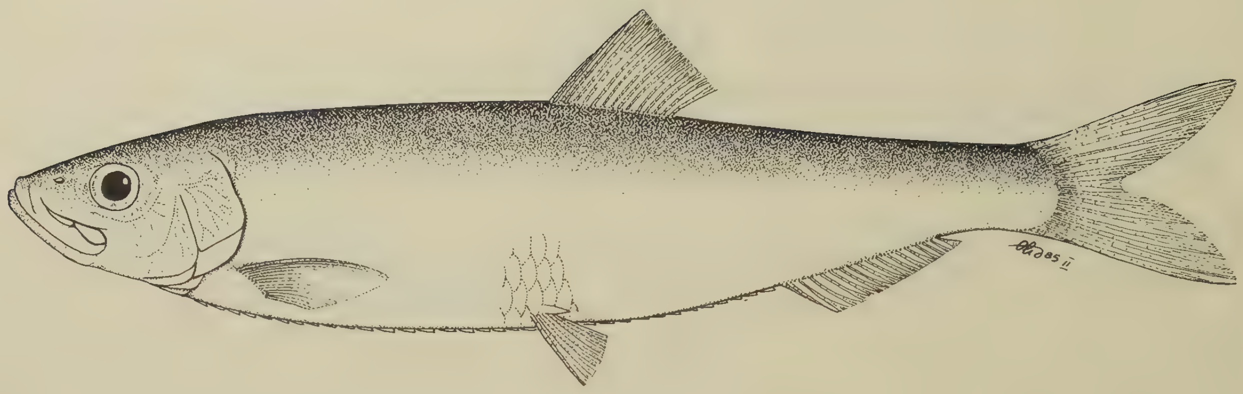
Sprattus sprattus (Linnaeus, 1758)

CLUP Spratt 1

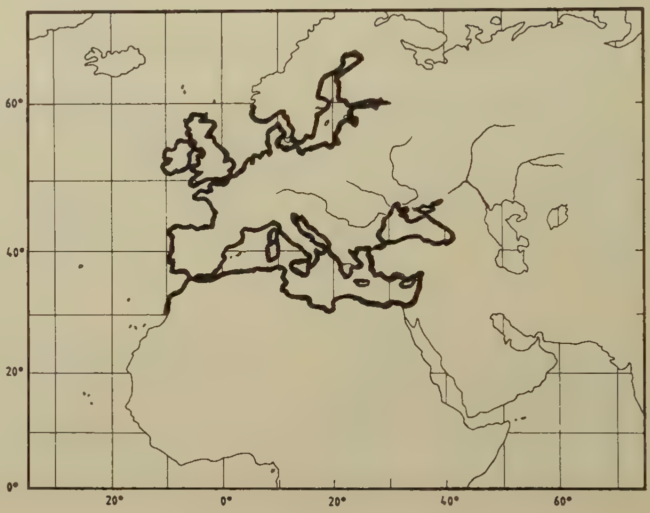
Clupea sprattus Linnaeus, 1758, *Syst.nat.*, 10th ed.:318 (Europe).

Synonyms: *Clupanodon phalerica* Risso, 1827:425; *Clupea latulus* Cuvier, 1829:318; *Clupea papalina* Bonaparte, 1845:34; *Clupea schoneveldii* Krøyer, 1846:193; *Spratella pumila* Valenciennes, 1847:357; *Meletta vulgaris* Valenciennes, 1847:366; *Clupea sprattus balticus* G. Schneider, 1904:66; *Clupea sulinae* Antipa, 1906:38; *Spratella serdinka* Nikolsky, 1923:2; *Sprattus sprattus* - Svetovidov, 1952:107, pl. 1, fig. 3; *Idem*, 1963:111 (in English); Demir, 1965:unp. (synopsis); CLOFNAM, 1973:104 (full synonymy); FNAM, 1984:224, fig. (synopsis).

FAO Names: En - European sprat.



Diagnostic Features : Lower jaw slightly projecting, gill cover without bony radiating striae, teeth rarely present on vomer; belly with a strong keel of scutes; pelvic finrays i 6 (rarely i 7), insertion of fin under or before the dorsal fin origin, last two anal finrays not enlarged. No dark spots on flanks. See CLUP Spratt 1, Fishing Area 37.



Geographical Distribution : Northeast Atlantic (from North Sea and Baltic south to Morocco; also Mediterranean, Adriatic, Black Sea).

Habitat and Biology : Marine pelagic and usually inshore schooling fishes, sometimes entering estuaries (especially the juveniles) and tolerating salinities as low as 4^0/oo; strong migrations between winter feeding and summer spawning grounds. Feeds on planktonic crustaceans. Some spawning almost throughout the year, near to the coast or up to 100 km out to sea, mainly in spring and summer, the young drifting inshore. Move to the surface at night.

Size : To 16 cm, usually to 12 cm standard length.

Interest to Fisheries : Of importance in North Sea, Baltic and off Norwegian coasts, with a total of 327 420 tons in 1983; more than two thirds of this was fished by Denmark and Norway. Mediterranean and Black Sea catches in 1983 were 43 193 tons, mostly by Yugoslavia and Bulgaria. Caught in trawls or driftnets, or driven up Norwegian fjords by nets and penned until needed by the canning factories (sold as 'brislings'); juveniles sold as 'white bait' (often mixed with juvenile herrings).

Local Names : Many variants on the names Sprott or Sprat, Espadín, Papalina and Brisling (see Bini, 1970:56).

Literature : Svetovidov (1952, 1963 - Russia); Demir (1965 - biology, synopsis); Banarescu (1968 - Black Sea); Wheeler (1969 - UK); Bini (1970 - Mediterranean); FNAM (1984 - synopsis).

Remarks : Small differences, mainly in numbers of post-pelvic scutes, have been used to define three subspecies:

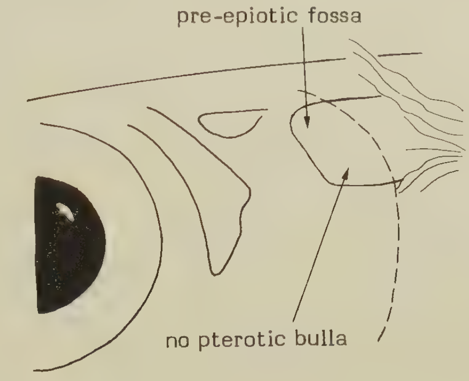
(a) S. sprattus sprattus: average post-pelvic scutes more than 11.5; Atlantic and North Sea coasts.
(b) S. sprattus phalericus: average post-pelvic scutes not more than 11.3; Mediterranean, Adriatic, Black Sea
(c) S. sprattus balticus: average post-pelvic scutes less than 11.5; Baltic Sea.

Clupeonella Kessler, 1877

CLUP Clupnla

Clupeonella Kessler, 1877, *Ryby Aralo-Kaspiisko-Ponti-cheskoi Oblasti*:187, pl. 6, fig. 24 (type: larva of *C. grimmi* Kessler, 1877).

Diagnostic Features : Absence of a pterotic bulla (bony dome on floor of pre-epiotic fossa), distinguishes *Clupeonella* from all other clupeine genera except *Sprattus* (which has the pelvic fin origin below or in front of the dorsal fin origin, and the last two anal finrays not enlarged). From other clupeinae that occur sympatrically, *Clupeonella* species differ in having no notch at the centre of the upper jaw (distinct notch in species of *Alosa*).



Biology, Habitat and Distribution : Pelagic, schooling, in brackishwater and euryhaline or purely fresh-water, some species anadromous. Found only in Sea of Marmora, Black Sea, Sea of Azov, Caspian and certain rivers affluent to these waters; apparently not entering Mediterranean.

Interest to Fisheries : One species (*C. cultiventris*) is among the top commercial fishes of the Sea of Azov; other species of seasonal or local interest.

Species : Following Svetovidov (1952, 1963), there are 4 species:

C. abrau (Malyatskii, 1930), Mediterranean region
C. cultriventris (Nordmann, 1840), Mediterranean region, Caspian Sea
C. engrauliformis (Borodin, 1904), Caspian Sea
C. grimmi Kessler, 1877, Caspian Sea.

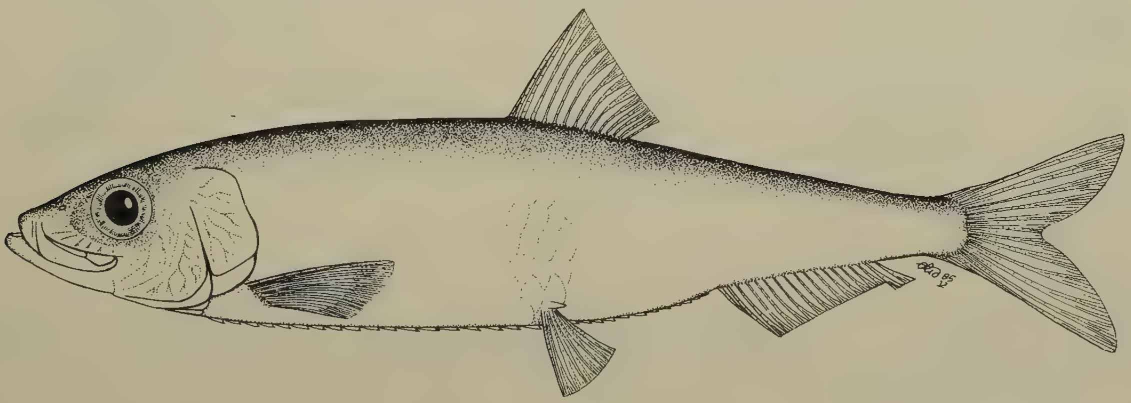
Clupeonella abrau (Malyatskii, 1930)

CLUP Clupnla 1

Harengula abrau Malyatskii, 1930, *Trudy azov.-cherno-morsk ryb.Khoz.Stantsii*, 6:65 (Lake Abrau, near Novorossiisk).

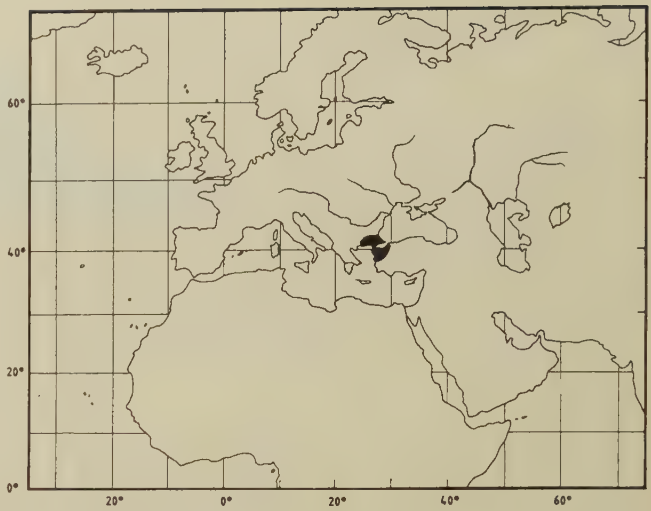
Synonyms : *Clupeonella muhlisi* Neu, 1934; *Clupeonella abrau* - Svetovidov, 1952:208, pl. 7, fig. 3; *Idem*, 1963:228, pl. 7, fig. 3 (in English).

FAO Names : En - Abrau sprat.



Diagnostic Features : Body moderately slender, its depth about 19 to 23% of standard length; head short and narrow, inter-orbital width not more than 17.5% of standard length; belly sharply keeled, with 23 to 26 scutes. Gillrakers 39 to 50. Pectoral fin tips pointed.

Geographical Distribution : Lake Abrau (freshwater, landlocked, at 70 m above sea level, near to Novorossiisk); not Lake Apolyont (Turkey), which is linked to Sea of Marmora (Meric, 1984).



Habitat and Biology : Freshwater, pelagic and schooling. Feeds on crustaceans (juveniles feed on copepods, rotifer eggs, plants). Breeds May to October, eggs pelagic, developing rapidly before sinking to bottom. Maturity after one year, at 3.5 to 4.5 cm.

Size : To 9.5 cm standard length (or 6 cm in Lake Abuliond).

Interest to Fisheries : Nil.

Local Names : USSR: Abrauskaya tyul'ka, Sardel'ka

Literature : Svetovidov (1952, 1963).

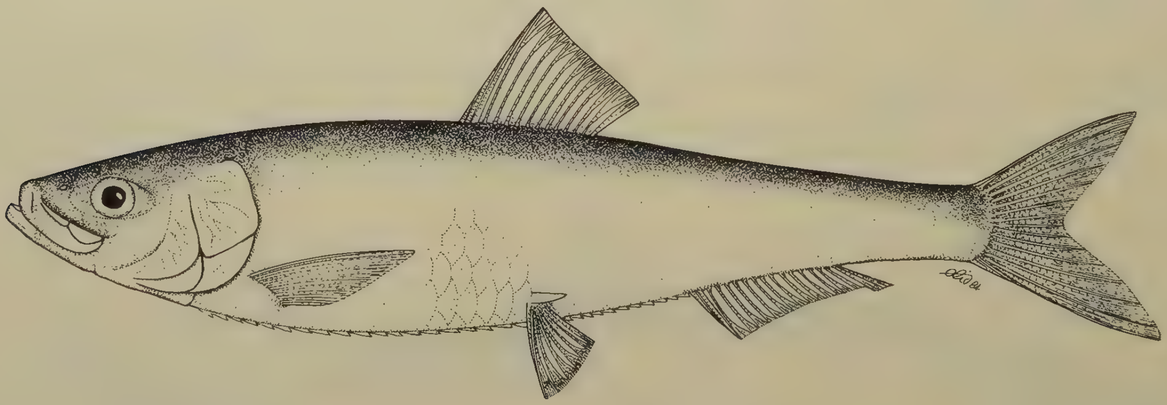
Clupeonella cultriventris (Nordmann, 1840)

CLUP Clupnla 2

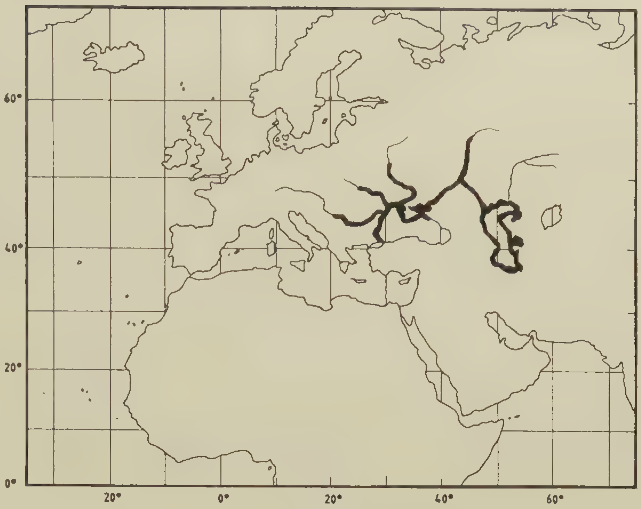
Clupea cultriventris Nordmann, 1840, Faune pontique, 3:522 (northern coast of Black Sea).

Synonyms : Clupea delicatula Nordmann, 1840:524 (pre-occupied by Clupea delicatula Bennett, 1831 = Spratelloides delicatulus); Clupeonella delicatula:Svetovidov, 1952:194, pl. 8, figs 1, 2, 3; Idem, 1963:212, pl. 8, figs 1, 2, 3 (in English); CLOFNAM, 1973:101 (full synonymy); FNAM, 1984:274, fig. (synopsis).

FAO Names : En - Black Sea sprat.



Diagnostic Features : Body moderately deep, its depth about 21 to 27% of standard length; head short and wide, inter-orbital width at least 17.5% of standard length; belly sharply keeled, with 24 to 29 scutes. Gillrakers 49 to 62. Pectoral fin tips pointed.



Geographical Distribution : Black Sea (northwestern parts), Sea of Azov and Caspian Sea, also most of the affluent rivers of the area, reaching as far as 60 km inland. Also, Lake Palaeostomi (Bulgaria) and in Bay of Feodosiya (Romania), also Lake Apolyont (Turkey).

Habitat and Biology : Pelagic, euryhaline, essentially a brackishwater species (tolerating salinities up to 34^{o}/oo), but with semi-anadromous and purely freshwater forms in rivers and lakes; migratory between winter or autumn feeding and summer spawning grounds. Feeds on zooplankton. Breeds in early summer in Sea of Azov (peak in May), and from about May in the lower reaches of rivers (Dneiper, Dneister).

Size : To 14.5 cm standard length, usually to 10 cm.

Interest to Fisheries : Of major importance in Sea of Azov (one of the top commercial fishes); stocks depleted in southern part of Caspian Sea (Coad, 1980:71 - *C. delicatula*). The total catch in 1983 was 396 731 tons.

Local Names : BULGARIA: Tzatza; ROMANIA: Gingirica; USSR: Tyul'ka.

Literature : Svetovidov (1952, 1963); Meric (1984 - growth, reproduction, distribution).

Remarks : Svetovidov (1952:194; 1963:212) recognized 2 subspecies, based on pectoral and pelvic fin length:

(a) *C. cultriventris cultriventris*: pectoral and pelvic fins long (17.5 to 21.5% and 11.5 to 14% of standard length respectively); Black Sea, Sea of Azov.

(b) *C. cultriventris caspia*: pectoral and pelvic fins shorter (15.5 to 19% and 8.5 to 12.5% of standard length respectively); Caspian Sea and basin.

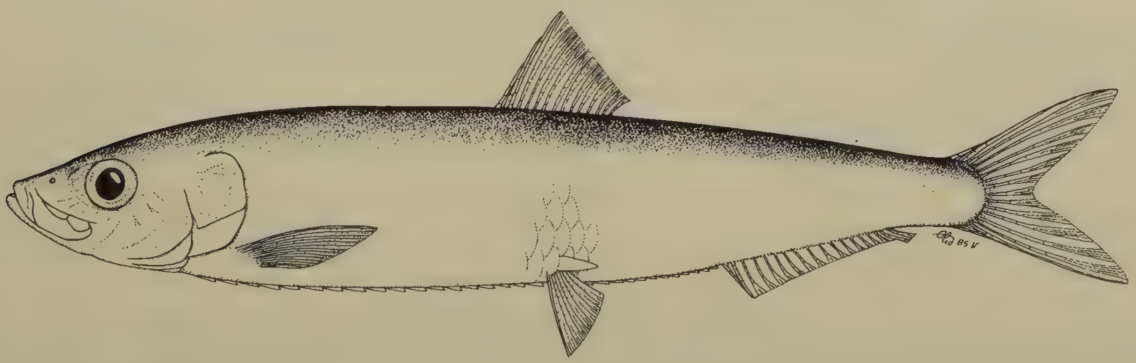
Clupeonella engrauliformis (Borodin, 1904)

CLUP Clupnla 3

Clupea engrauliformis Borodin, 1904, *Vest.Rÿbopromyshlennosti*, 19(6):335 (Buinaksh, central part of Caspian Sea).

Synonyms : *Clupeonella engrauliformis* - Svetovidov, 1952:205, pl. 7, fig. 2; *Idem*, 1963:225, pl. 7, fig. 2 (in English).

FAO Names : En - Anchovy sprat.



Diagnostic Features : Body slender, its depth about 16 to 19% of standard length; head short and wide, inter-orbital width 16 to 18.5% of standard length; belly rounded, with 23 to 31 scutes. Gillrakers 56 to 67. Pectoral fin tips pointed.

Geographical Distribution : Caspian Sea (middle and southern parts).

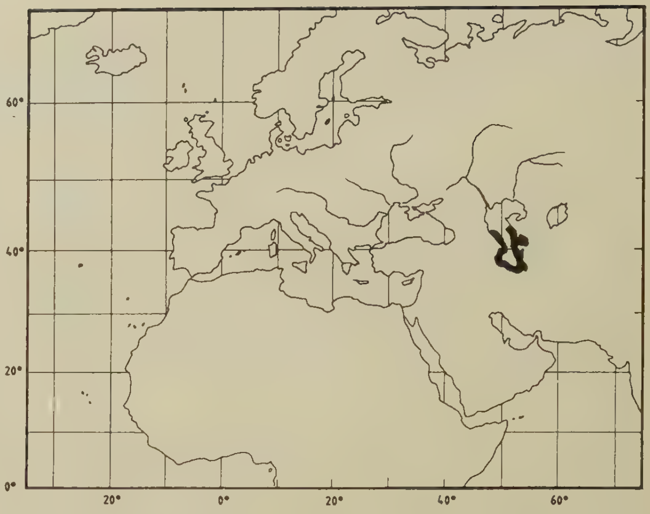
Habitat and Biology : Mainly in open sea, only occasionally approaching the shore, sometimes massing in large schools, rising to the surface in the spring months, but descending to as much as 78 m in late summer (apparently rising again in October-November, but descending once more in winter). Breed from end-April to November, mostly in July, intermittently and in the open sea.

Size : To 15.5 cm standard length, usually 11.5 to 12.5 cm (females a little larger than males).

Interest to Fisheries : Caught together with *C. cultriventis caspia* by coastal fisheries or separately by light fishing in open sea. May rival or exceed catches of *C. cultriventris caspia*, although stocks claimed to be depleted in southern part of Caspian Sea (Coad, 1980:71).

Local Names : USSR: Anchousovidnaya tyul'ka.

Literature : Svetovidov (1952, 1963).



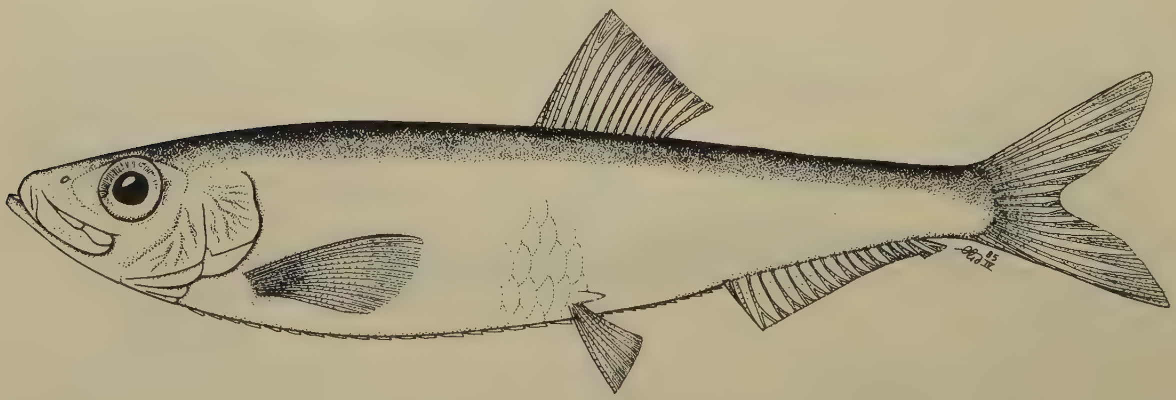
Clupeonella grimmi Kessler, 1877

CLUP Clupnla 4

Clupeonella grimmi Kessler, 1877, Ryb.Aralo-Kapiiskoi-Ponticheskoi Oblasti:187, pl. 6, fig. 24 (larvae, central part of Caspian Sea).

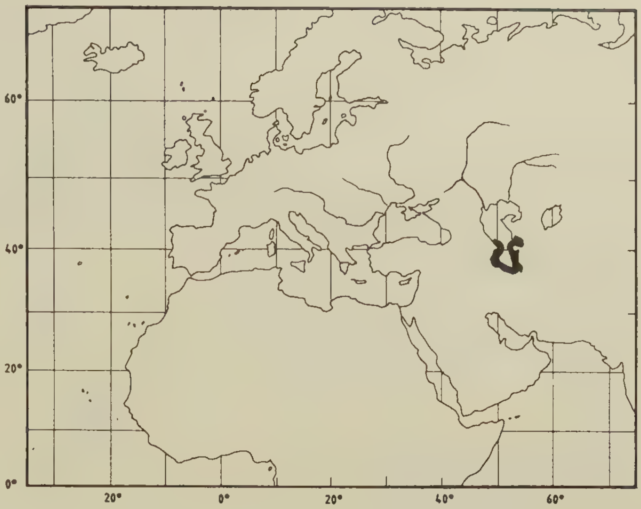
Synonyms : *Clupeonella grimmi* - Svetovidov, 1952:209, pl. 7, fig. 1; *Idem*, 1963:230, pl. 7, fig. (in English).

FAO Names : En - Southern Caspian sprat.



Diagnostic Features : Body moderately slender, its depth about 17 to 22% of standard length; head long and narrow, inter-orbital width 13 to 15% of standard length; belly sharply keeled, with 26 to 32 scutes. Gillrakers 42 to 51. Pectoral fin tips rounded.

Geographical Distribution : Caspian Sea (mainly in south, absent in north).



Habitat and Biology : In open sea, not approaching shores; in winter, found mainly in southern part, migrating to middle parts of sea in spring (especially the eastern half), returning south in November-December; occurs in upper layers in March-April, but descend to 16 to 32 m in summer and autumn. Feeds mainly on copepods, also pelagic mysids and small fishes. Breeds in January-September, intermittently and in the open sea.

Size : To 14.5 cm standard length, usually 10.5 to 11 cm (females a little larger than males).

Interest to Fisheries : Of potential value, but not caught by coastal fisheries; stocks said to be depleted in southern part of Caspian Sea (Coad, 1980:71).

Local Names : USSR: Bolsheglazaya tyul'ka.

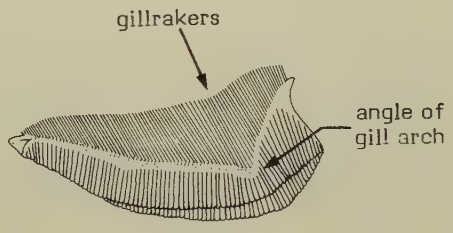
Literature : Svetovidov (1952, 1963).

Sardina Antipa, 1906

CLUP Sardi

Arengus Cornide, 1788, Ens.hist.peces...Galicia:91 (suppressed, Opinion 799, Int.Comm.Zool.Nomencl.). Sardina Antipa, 1906, Denkschr.Akad.Wiss.Wien, 78:54 (after Sardina Antipa, 1904) (type: Sardina dobrogica Antipa, 1906).

Diagnostic Features : Resembles Sardinops (non-European) in having lower part of gill cover with distinct bony striae radiating downward (in addition to the normal fleshy radiating canals), but lower gillrakers not shortened at angle of first arch, maxilla not reaching to eye centre and scales on flank of uneven sizes (smaller scales hidden beneath the larger ones).

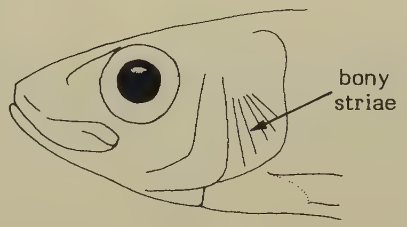


Biology, Habitat and Distribution : Marine, pelagic and schooling fishes, especially of coastal waters; restricted to Northern Hemisphere (northeastern Atlantic and Mediterranean region).

Interest to Fisheries : Abundant in some areas and of considerable commercial importance, both as adults (pilchards) and as juveniles (sardines).

Species : A single species recognized:

S. pilchardus (Walbaum, 1792), northeastern Atlantic, Mediterranean.



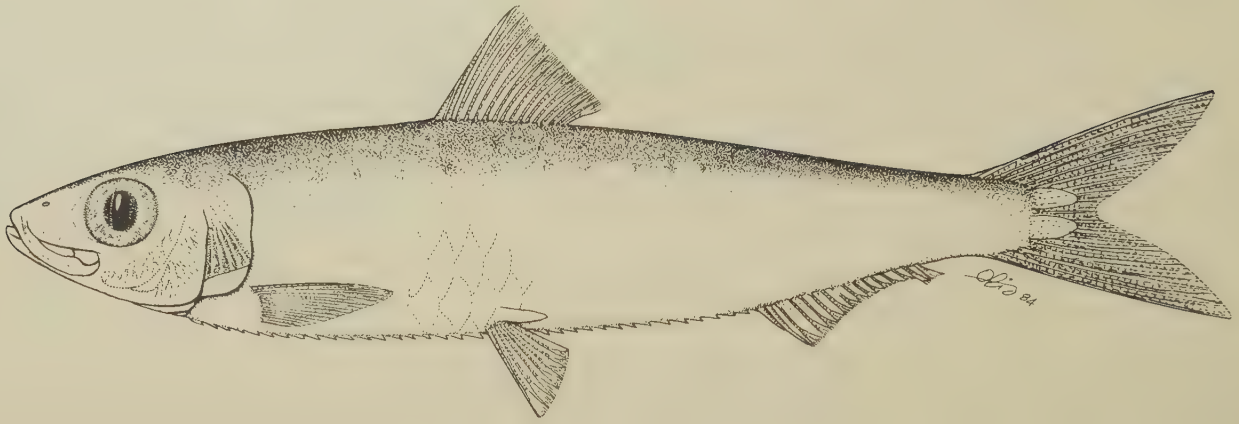
Sardina pilchardus (Walbaum, 1792)

CLUP Sardi 1

Clupea pilchardus Walbaum, 1792, in Artedi, Gen.pisc.:38 (Cornwall, on Pennant, 1769).

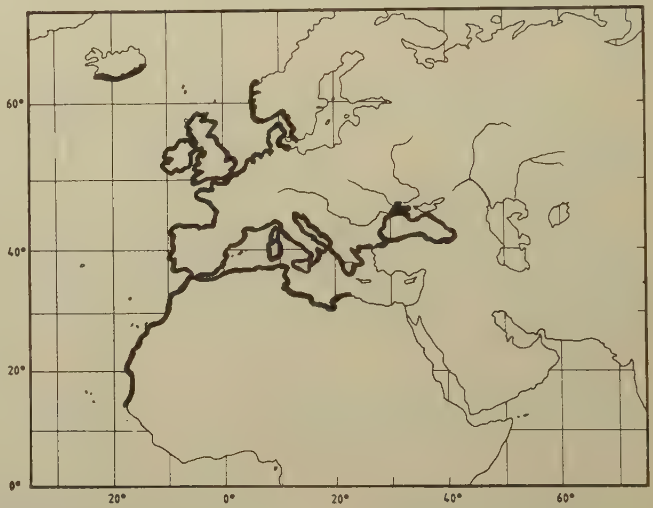
Synonyms : Arengus minor Cornide, 1788:91 (suppressed by Opinion 799, Int.Comm.Zool.Nomencl.); Clupanodon sardina Risso, 1827:452 (Nice); Clupea sardinia (cheironym?):Lowe, 1837:189 (Madeira); Clupea laticosta Lowe, 1843:90 (Madeira); Clupea pilchardus var.2 sardinia:Günther, 1868:440 (Madeira); Sardina dobrogica Antipa, 1906; Sardina pilchardus - Svetovidov, 1952:188, pl. 6, fig. 2; Idem, 1963:205, pl. 6, fig. 2; CLOFNAM, 1973:102; FNAM, 1984:276, fig. (synopsis); CLOFETA, in press.

FAO Names : En - European pilchard.



Diagnostic Features : Body subcylindrical, belly rather rounded (but body more compressed in juveniles). Hind margin of gill opening smoothly rounded (without fleshy outgrowths); 3 to 5 distinct bony striae radiating downward on lower part of operculum; lower gillrakers 44 to 106, not becoming shorter at angle of first gill arch, the upper series not overlapping the lower. Pelvic fin insertion well behind dorsal fin origin; last two anal finrays enlarged. A series of dark spots along upper flanks, sometimes with a second or even third series below. See CLUP Sardi 1, Fishing Areas 34, 47 (in part).

Geographical Distribution : Coasts of eastern North Atlantic, from Iceland (rare) and North Sea, southward to Bay de Gorée, Senegal (14°43'N) (extension of southern limit by about 15° in the last decade); also Mediterranean (common in western part and in Adriatic, rare in eastern part), Sea of Marmara and Black Sea.



Habitat and Biology : Coastal, pelagic, usually at 25 to 55 or even 100 m by day, rising to 10 to 35 m at night, schooling, migratory, Feeds mainly on planktonic crustaceans, also larger organisms. Breeds at 20 to 25 m, near the shore or as much as 100 km out to sea from April (English Channel), June to August (North Sea, also Black Sea), September to May (off European coasts of Mediterranean) and November to June (off African coasts of Mediterranean).

Size : To 25 cm standard length, usually to 20 cm.

Interest to Fisheries : The total catch for 1983 was 930 310 tons (Area 27, eastern North Atlantic, 202 599 tons; Area 34, eastern central Atlantic, 484 061 tons; Area 37, Mediterranean, 243 650 tons). *Sardina pilchardus* was the fourth most important commercially exploited clupeoid species in that year. Caught with purse seines and lamparas (light fishing), also gillnets, beach seines, trap nets and occasionally high opening bottom trawls (French Mediterranean coast).

Local Names : Variations on Sardele, Sardina, Sardine, etc. (see CLUP Sardi 1, Fishing Area 37; also Gómez Larrañeta, 1960:140).

Literature : Svetovidov (1952, 1963 - Russia); Gómez Larrañeta (1960 - biology, synopsis); Banarescu (1968 - Black Sea); Wheeler (1969 - UK); Bini (1970 - Mediterranean), FNAM (1984 - synopsis).

Remarks : Authors (e.g. Svetovidov, 1952, 1963) have often recognized two subspecies, based mainly on gillrakers counts and head length, but the separation is not satisfactory:

(a) *S. pilchardus pilchardus*: lower gillrakers more than 60, head length 20 to 23% of standard length; Atlantic (Bergen to Gibraltar).

(b) *S. pilchardus sardina*: lower gillrakers 44 to 70 (but sometimes to 106), head length 18.5 to 21.0% of standard length; Mediterranean, Black Sea, Atlantic (Gibraltar to C. Blanc). However, specimens from Gorée Bay, Senegal, have 59 to 90 lower gillrakers and head length 24.5½ to 28.2% of standard length (Fréon & Stequert, 1978).

Other races, forms, varieties and possible subspecies have been suggested for populations in the western Mediterranean (reviewed by Gómez Larrañeta, 1960), off western Sahara (Furnestin, 1955) and off Mauritania (Maurin, 1968).

Sardinops Hubbs, 1929

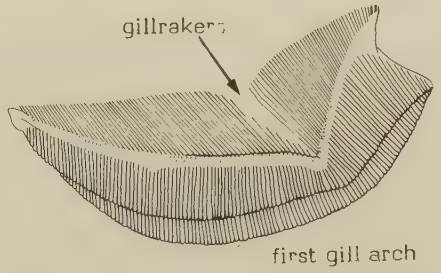
CLUP Sardop

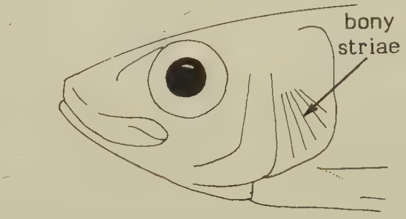
Sardinops Hubbs, 1929, *Proc.Calif.Acad.Sci.* (4)**18**(11):264 (type: *Meletta caerulea* Girard, 1854). Note that Article 30(a)(ii) of the International Code considers all genera ending in -ops to be masculine, hence *caeruleus*, not *caerulea*, etc.

Diagnostic Features: Resembles *Sardina* of European waters in having lower part of gill cover (operculum) with distinct bony striae radiating downward (in addition to the normal fleshy radiating canals), but lower gillrakers are shortened at angle of first arch and overlapped by upper gillrakers, maxilla reaches or almost reaches eye centre and scales on flank of even size (no smaller ones hidden beneath). No other clupeoid fishes have bony striae on the operculum.

Biology, Habitat and Distribution: Marine, pelagic and schooling fishes, especially of coastal waters; antitropical distribution (eastern North and South Pacific, southern Africa, Australia, New Zealand).

Interest to Fisheries: The five species (or subspecies) of *Sardinops* contributed about 1/4 of all clupeoid fishes caught, making this the most productive of all clupeoid genera (8 250 201 tons in 1983); *Sardinops* was exceeded only by the Peruvian anchovy during the peak of the latter's exploitation (1962 to 1971).





Species: Svetovidov (1952:178; 1963:193) considered that the published differences between the five 'species' of *Sardinops* were not significant, except perhaps in the case of the Australian pilchard; he preferred to recognize five subspecies of *Sardinops sagax*, at least until more detailed comparative studies were made. Recent (unpublished) electrophoretic studies of proteins by Dr Stuart Grant have tended to show that at least *S. caeruleus*, *S. neopilchardus*, *S. melanostictus* and *S. ocellatus* hardly differ genetically. Nevertheless, the five populations are so widely separated geographically that any exchange of genetic material is either impossible or highly unlikely. For this reason 5 species are given here:

S. caeruleus (Girard, 1854), eastern North Pacific
S. melanostictus (Temminck & Schlegel, 1846), western North Pacific
S. neopilchardus (Steindachner, 1879), western South Pacific
S. ocellatus (Pappe, 1854), southern Africa
S. sagax (Jenyns, 1842), eastern South Pacific.

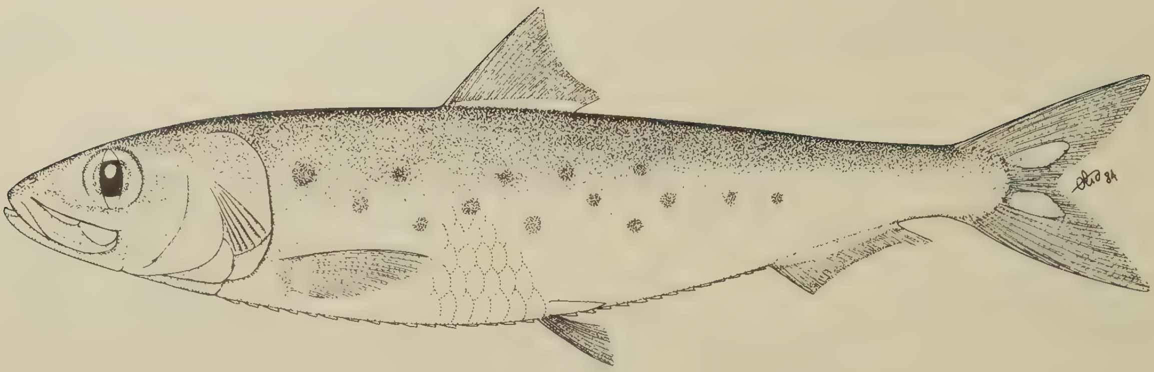
Sardinops caeruleus (Girard, 1854)

CLUP Sardop 4

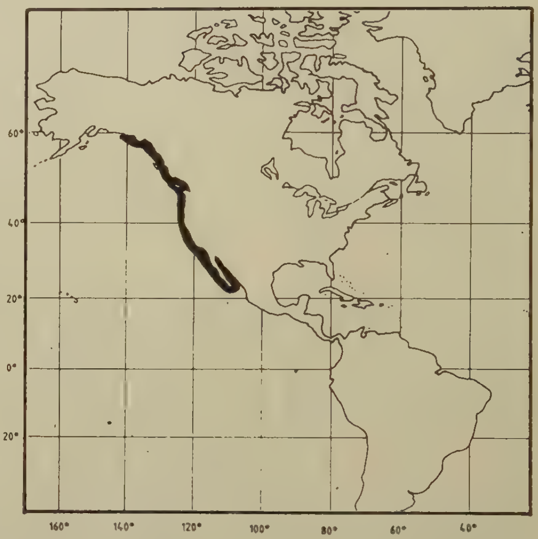
Meletta caerulea Girard, 1854, *Proc.Acad.nat.Sci.Philad.*, **7**:138 (San Francisco).

Synonyms: *Alausa californica* Gill, 1862:33; *Sardina sagax* (part):Regan, 1916:13 (combined with *sagax*, *melanosticta* and *ocellata*); Clemens & Wilby, 1961:101, fig. 35 (Canada, Pacific); Hart, 1973:100, fig. (Canada, Pacific, synopsis); *Sardinops caeruleus* - Hubbs, 1929:265 (doubted species status, however); Ahlstrom, 1960:417 (synopsis); Fitch & Lavenberg, 1971:54, fig. 16 (California); Miller & Lea, 1972:54.

FAO Names: En - California pilchard.



Diagnostic Features : The radiating bony striae on the operculum distinguishes this species from all other clupeids in the area; in addition, Clupea pallasii has the pelvic fin insertion before the dorsal fin origin and lacks spots on the flanks; Etrumeus teres lacks scutes along the belly; and Alosa sapidissima is deeper-body and has a distinct median notch in the upper jaw.



Geographical Distribution : Alaska (southeastern coast) south to C. San Lucas and throughout the Gulf of California.

Habitat and Biology : Coastal, pelagic, in large (or in the past very large) schools (up to 10 million individuals estimated in times of abundance); migratory, with a definite northward movement between California and British Columbia waters in summer and return (autumn, winter). Feeds on zooplankton (chiefly small crustaceans), also phytoplankton, mainly by filter-feeding; also by 'pecking' at individual animals. Breeds mainly off the southern California coast about 80 km offshore between Point Conception and San Diego; January to June, but a peak in April to May (at night); eggs pelagic; some individuals spawn in their first year, but most in their second; scale studies suggest that some fishes live 20 to 25 years.

Size : To about 36 cm standard length; usually to 25 cm.

Interest to Fisheries : Landings (variously 70 to 100% from California) reached a peak in 1936 (791 100 tons), but from 1944 declined until the California fishery collapsed and a moratorium was declared (1967). The total catch for 1983 was 31 601 tons.

Local Names : USA: Pacific sardine (AFS list).

Literature : Ahlstrom (1960 - biology, fishery, synopsis); Marr (1960 - fishery); Radovich (1960 - fishery); Clemens & Wilby (1961 - Canada, synopsis); Fitch & Lavenberg (1971 - California, synopsis), Hart (1973 - Canada, synopsis, biology an excellent summary).

Remarks : Hildebrand (1946:87) compared Peruvian and Californian pilchards and failed to find significant differences. Of all the pilchards, these two are most likely to be the same species, in which case the name Pacific pilchard should be given to both. Nevertheless, Miller & Lea (1972:212) stated that J.E. Fitch had discovered significant otolith and other differences suggesting that S. caeruleus and S. sagax are distinct species and not subspecies.

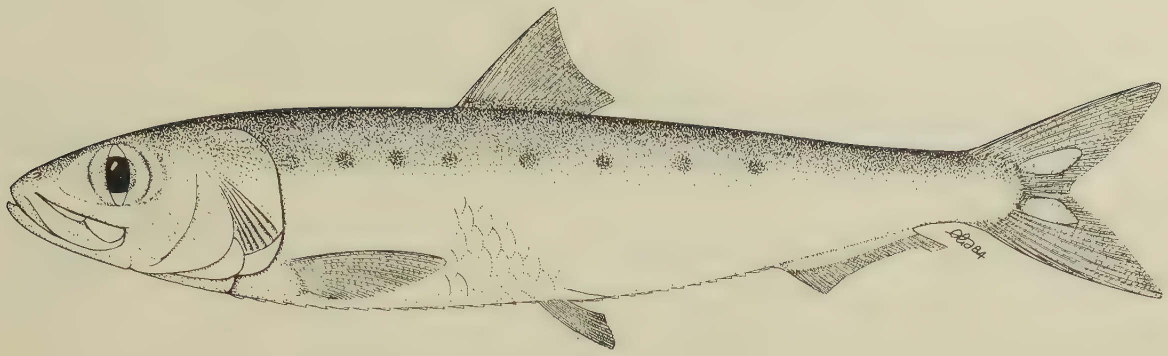
Sardinops melanostictus (Schlegel, 1846)

CLUP Sardop 5

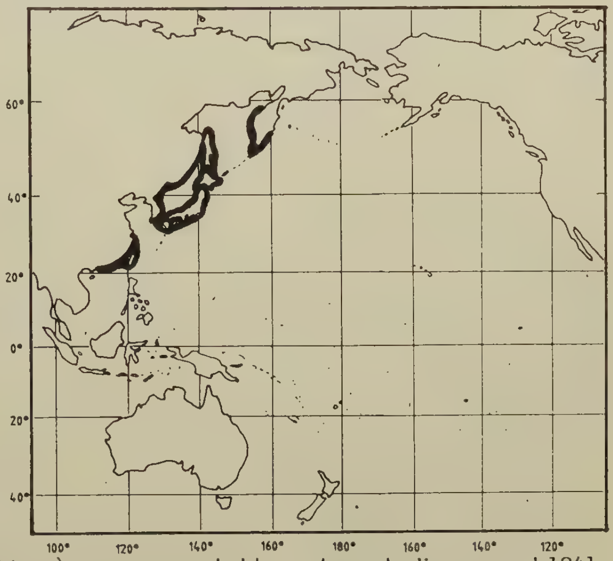
Clupea melanosticta Temminck & Schlegel, 1846, Fauna Japonica, Poiss., pt. 5, inst. 13:237, pl. 108, fig. 3 (Japan).

Synonyms : Sardina sagax (part):Regan, 1916:13 (combined with sagax, ocellata and caerulea); Sardinops melanosticta - Hubbs, 1929:265; Anon., 1960:213 (synopsis); Sardinops sagax melanosticta:Svetovidov, 1952:178, pl. 6, fig. 1; Idem, 1963:193, pl. 6, fig. 1.

FAO Names : En - Japanese pilchard.



Diagnostic Features : The radiating bony striae on the operculum distinguish this fish from all other clupeoids in the area; in addition, species of Sardinella and Herklotsichthys have two fleshy outgrowths on the hind margin of the gill opening and no series of dark spots along the flank (Amblygaster sirm has similar spots, but seems to be rare north of Taiwan Island, possibly to Okinawa); Clupea pallasii has the pelvic fin insertion before the dorsal fin origin and lacks spots on the flank; and Etrumeus teres and Dussumieria elopsoides lack scutes along the belly, also no spots.



Geographical Distribution : USSR (western coast of Sea of Japan, rarely to Sea of Okhotsk near eastern coasts of Sakhalin and in Bering Sea to coasts of Kamchatka Peninsula, absent in winter), Japan (all coasts), the Koreas (east coast only), China (Taiwan Island, Hong Kong).

Habitat and Biology : Coastal pelagic, forming large schools, migratory, moving northward in summer and tending also to move more inshore, the reverse as temperatures begin to drop. Feeds mainly on zooplankton, especially copepods, but also phytoplankton. Breeds from December to the beginning of May, earlier in the southern than the northern parts of range, in bays and in coastal parts of open sea; fishes mostly mature in second year.

Size : To 24 cm standard length, usually 15 to 20 cm.

Interest to Fisheries : One of the most important commercial fishes of Japan. The total catch for 1983 was 4 219 677 tons. Record catches in 1934-39 (over 2 000 000 tons) were succeeded by a sharp decline around 1941, with only partial recovery from 1945 and then further decline. Fluctuations in the catches and their relationship to the Kuroshio current were reviewed by Kawasaki (1979) and Watanabe, Honjo & Okutani (1979).

Local Names : JAPAN: Maiwashi; THE KOREAS: Chong-o-ri; USSR: Ivasi; see Anon. (1960:217) for local vernacular names.

Literature : Svetovidov (1952, 1963 - full synopsis of biology); also, see Anon. (1960 - biology, synopsis); Nakai (1960 - fisheries); Kurita (1960 - fisheries); Uda (1960 - fisheries); Hayashi (1960 - fisheries). A great deal of Japanese literature is available, summarized to 1959 by the papers cited here.

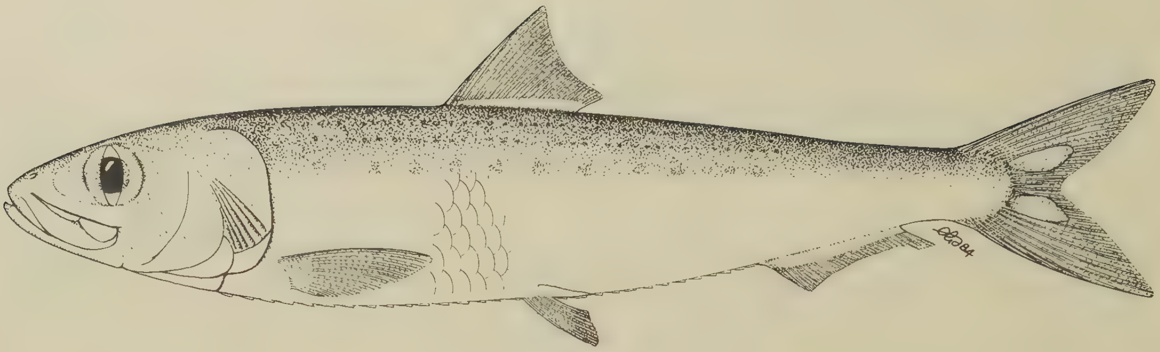
Sardinops neopilchardus (Steindachner, 1879)

CLUP Sardop 1

Clupea neopilchardus Steindachner, 1879, Denkschr.Akad.Wiss.Wien, **41**(1):12 (Hobson's Bay, Victoria, Australia).

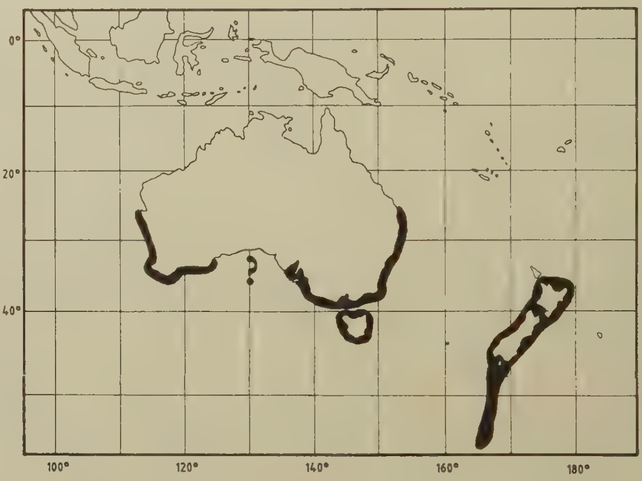
Synonyms : Clupea lata Richardson & Gray, 1843:221 (nomen nudum); Sardina neopilchardus:Regan, 1916:14, pl. 1, fig. 1; Sardinops neopilchardus - Hubbs, 1929:265; Blackburn, 1941 (biology); Idem, 1949:9 (biology); Idem, 1960:247 (synopsis); Baker, 1972:15 (New Zealand).

FAO Names : En - Australian pilchard.



Diagnostic Features : The radiating bony striae on the operculum distinguish this fish from all other clupeids in the area; in addition, species of Sardinella and Herklotsichthys have two fleshy outgrowths along the hind margin of the gill opening and no series of dark spots along flank (Amblygaster sirm has similar spots, but occurs off the northern coasts of Australia); Etrumeus teres lacks scutes along the belly. See CLUP Sardop 1, Fishing Areas 57, 71.

Geographical Distribution : Australia (southern coasts, to 24°S on the western side and to 25°S on the eastern side, reaching southward to 43°S off eastern Tasmania) and New Zealand (north to 34°S, down entire eastern and most of western coasts, also Cook Straight, southward to Auckland Island at 57°S).



Habitat and Biology : Coastal pelagic, forming large schools (at surface during breeding season and in southern New South Wales at surface also when juveniles leave bays to join the adult schools). Feeds mainly on crustaceans (copepods, ostracods, euphausiids, mysids), also mollusc larvae and phytoplankton (diatoms). Breeds in spring and summer in southern part of range, and in winter in northern part, apparently related to seasonal movement of the limiting 14° and 21°C isotherms. Mature at 8 to 13 cm, mostly at 12 cm or above in New Zealand.

Size : To 21.3 cm standard length, usually to 18 cm.

Interest to Fisheries : Insignificant, but sometimes used for bait. Caught with various forms of seine net.

Local Names : AUSTRALIA: Pilchard; NEW ZEALAND: Pilchard.

Literature : Blackburn (1941, 1949, 1950, 1951, 1960 - biology, fisheries); Baker (1972 - New Zealand, breeding, growth).

Remarks : In New Zealand the species appears to grow larger (21.3 cm standard length; cf. 19.7 cm), has slightly larger eggs and a higher mean number of vertebrae (50.52; cf. 49 to 50.08 in various samples) (Baker, 1972:17).

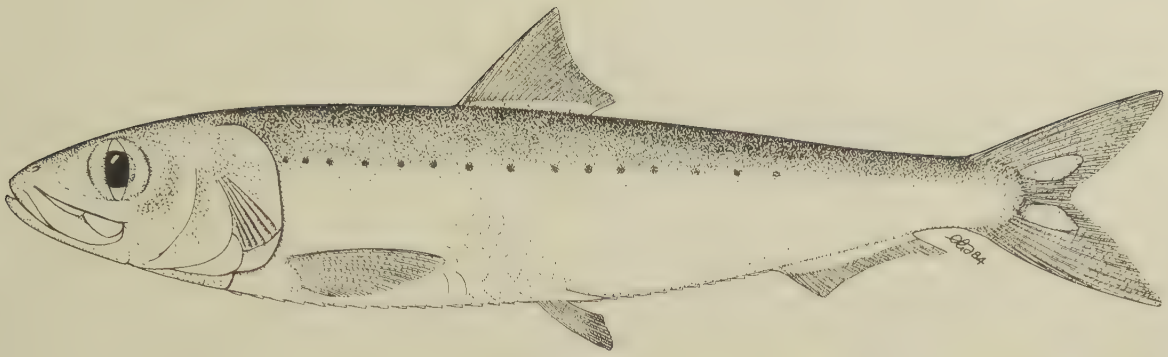
Sardinops ocellatus (Pappe, 1854)

CLUP Sardop 2

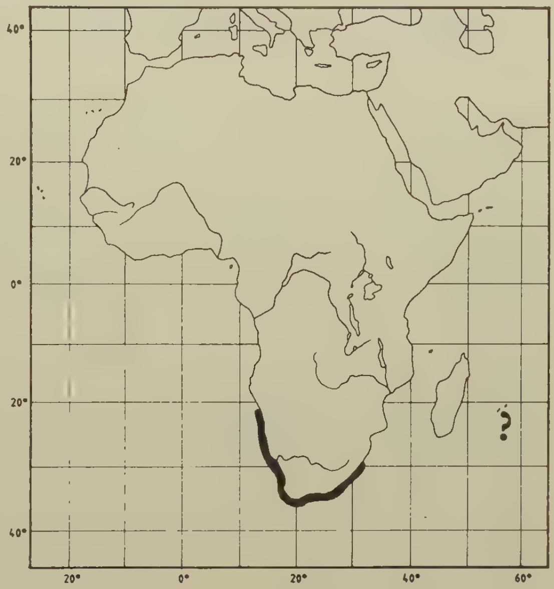
Clupea ocellata Pappe, 1854, Syn.edible fish Cape of Good Hope:20 (Cape of Good Hope).

Synonyms : Sardinops sagax (part) Regan, 1916:13, pl. 1, fig. 1 (combined with sagax, melanosticta and caerulea); Sardinops ocellata - Hubbs, 1929:265; Smith, 1953:92, pl. 5 (as Arengus sagax in Smith, 1969:92); Monteiro, 1960:1105 (Angola); CLOFETA, in press; SFSA, in press (southern Africa).

FAO Names : En - Southern African pilchard.



Diagnostic Features: The radiating bony striae on the operculum distinguish this fish from all other clupeids in the area; in addition, species of Sardinella and Herklotsichthys have two fleshy outgrowths along the hind margin of the gill opening and no series of dark spots along flank (Amblygster sirm has similar spots, but not recorded from South African coasts); Hilsa kelee has spots on flanks but is deeper-bodied and has a distinct median notch in the upper jaw; and species of Etrumeus and Dussumieria lack scutes along the belly. See CLUP Sardop 2, Fishing Areas 34 and 51.



Geographical Distribution: Angola (Baia dos Tigres, Porto Alexandre) southward to Cape Town and north to Natal (Durban); possibly to Mauritius.

Habitat and Biology: Coastal pelagic, forming large schools, migratory (but northern stocks perhaps rarely moving south of Orange River, thus South African stocks separate; on east coast, seasonal migration northward to Durban in June/July). Feeds on zooplankton (mainly copepods) when young, but on phytoplankton (mainly diatoms) from about 10 cm standard length; a non-selective filter feeder. Breeds mainly from September to February.

Size: To 28 cm standard length, usually to 25 cm.

Interest to Fisheries: The total catch for 1983 was 110 229 tons (South Africa 61 814 tons; Namibia 44 014 tons), virtually all from the western and southern coasts. Small catches by foreign nations, chiefly Poland.

Local Names: SOUTH AFRICA: Sud Afrikaanse pelser.

Literature: Davies (1957 - biology, synopsis); Du Plessis (1960 - fishery); De Jager (1960 - biology); Mathews (1960, 1964 - biology); King & Macleod (1976 - feeding). Biology and fishery data are given in many of the Investigational Reports of the Sea Fisheries Branch of the South African Department of Industries from 1954 onward.

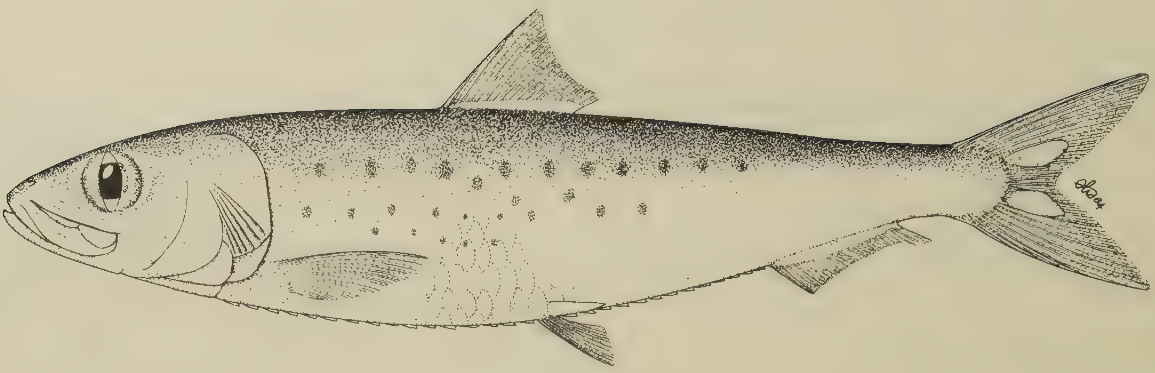
Sardinops sagax (Jenyns, 1842)

CLUP Sardop 3

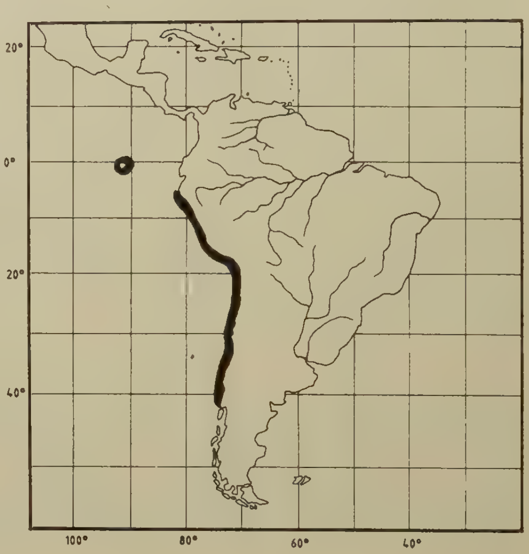
Clupea sagax (Jenyns, 1842, Zool.voy.Beagle, fishes:134 (Lima, San Lorenzo Island, Peru).

Synonyms: Alosa musica Girard, 1854:199 (Chile); Clupea advena Phillippi, 1879:161, pl. 10 (Chile); Arengus sagax:Fowler, 1945:3 (all Chile refs); Sardinops sagax - Mann, 1954:131; Hildebrand, 1946:86; de Buen, 1960:265 (synopsis); Boré & Martinez, 1981:unpaged (synopsis); Leible & Alveal, 1982:18 (synopsis).

FAO Names: En - South American pilchard.



Diagnostic Features : The radiating bony striae on the operculum distinguish this species from all other clupeids in the area; in addition, *Ethmidium maculatum* has dark spots on the flank, but is deeper-bodied and has a distinct median notch in the upper jaw; *Strangomera bentincki* has a slender body, but lacks the spots and last two anal finrays not enlarged.



Geographical Distribution : Peru and Chile (Sechura Bay at 5°S southward to Mocha Island, Chile, at 38°30'S; also Galapagos Islands).

Habitat and Biology : Coastal pelagic, caught down to depths of about 40 m, in summer at 16° to 23°C, in winter at 10° to 18°C. Forms large schools in the Peru Current. Feeds mainly on planktonic crustaceans. Breeds twice in one year (at least off Chile), from July to September and a lesser spawning from February to March throughout the area between Africa and southwest of Antofagasta (eggs also recorded off Valparaiso); mature from about 24 cm.

Size : To about 30 cm standard length, usually around 20 cm.

Interest to Fisheries : The total catch for 1983 was 3 888 694 tons (Peru 1 064 448 tons, Chile 2 823 424 tons). Caught with purse seines; in 1979, there were 3 ships operating in the northern zone of Chile (Arica, Iquique, Antofagasta) and 41 from Talcahuano; and of the total catch (1 618 937 tons), 90% was used for fishmeal or oil, 4% was canned and the rest marketed fresh or frozen.

Local Names : CHILE: Sardina española; ECUADOR: Sardina; PERU: Sardina.

Literature : Hildebrand (1946 - Peru); de Buen (1960 - biology, synopsis); Alberti (1960 - fishery, Antofagasta and Iquique); Boré & Martinez (1981 ; Chile, synopsis, fishery data).

Remarks : De Buen (1958, 1960:270) recognized two subspecies and suspected that the Galapagos population represented at least an isolated stock:

S. sagax sagax: head length 27 or 28.5% of standard length, pre-dorsal distance 47 to 50% of standard length, pectoral fin length 53 to 55.5% of head length; Peru.

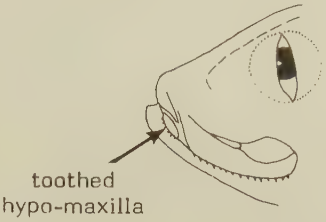
S. sagax musica: head length 25.5 to 26.1% of standard length, pre-dorsal distance 45.1 to 47.6% of standard length, pectoral fin length 51.5 to 58% of head length; Chile.

Harengula Valenciennes, 1847

CLUP Har

Harengula Valenciennes, 1847, *Hist.nat.poiss.*, **20**:227 (type: *Harengula latulus* Valenciennes = *Clupea clupeola* Cuvier, 1829). *Hyrtlinus* Fowler, 1958, *Notul.Nat.*, (310):5 (type: *Hyrtlinus altiforma* Fowler = *Harengula jaguana* Poey).

Diagnostic Features : The presence of a small toothed hypomaxilla between the hind tip of the pre-maxilla and the expanded blade of the maxilla distinguishes *Harengula* from *Sardinella* and all other clupeoid genera, except the pristigasterids *Pellona* and *Pliosteostoma*, which have a long anal fin with more than 30 finrays (about 16 to 19 in *Harengula*), its base much longer than that of the dorsal fin (about equal in *Harengula*). Lower gillrakers less than 45 (more than 45 in adult *Sardinella* of New World).



Biology, Habitat and Distribution : Marine, pelagic and schooling fishes, especially of coastal waters. New World only (Atlantic and Pacific coasts), mainly in tropical and subtropical waters.

Interest to Fisheries : No major fisheries, but contribute to clupeoid catches.

Species : The most recent revision (Rivas, 1964) recognized 3 Atlantic and 1 Pacific species:

H. clupeola (Cuvier, 1829), western Atlantic
H. humeralis (Cuvier, 1829), western Atlantic
H. jaguana Poey, 1865, western Atlantic
H. thrissina (Jordan & Gilbert, 1882), eastern Pacific.

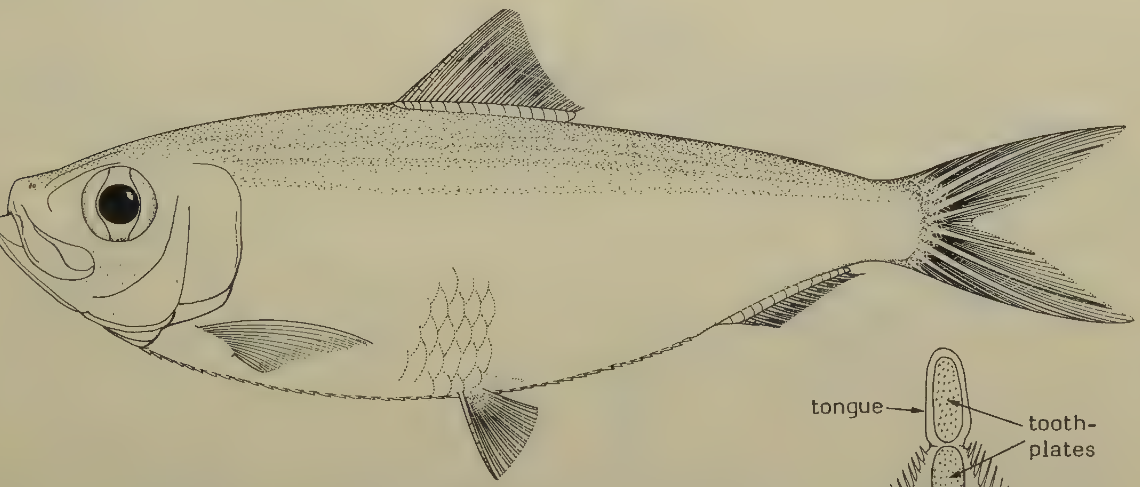
Harengula clupeola (Cuvier, 1829)

CLUP Har 1

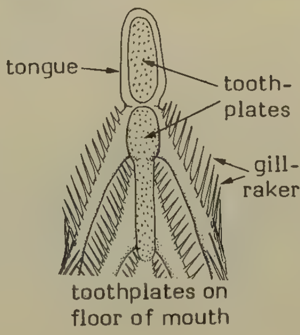
Clupea clupeola Cuvier, 1829, *Règne anim.*, 2nd ed., **2**:318 (footnote, on *Cailleu* of Duhamel, 1776, *Traité gén. pêches*, pt. 2, (3): pl. 31, fig. 3; reproduced by Storey, 1938: fig. 16).

Synonyms : *Clupea macrophthalma* Ranzani, 1842:320, pl. 23, figs 1-4 (? Brazil); *Harengula latulus* Valenciennes, 1847:280, pl. 595 (? locality); ? *Alosa bishopi* Müller & Troschel, 1847:675 (Barbados); Schomburgk, 1848:19 (repeat); *Harengula clupeola* - Storey, 1938:29; Rivas, 1950:289; FWNA, 1964:390, fig. 96; Cervigón, 1966:124, fig. 52; Whitehead, 1967:26 (*H. latulus* types, not from northern France, but from western Atlantic); *Idem*, 1973a:38, fig. 10 (Guianas); Whitehead & Bauchot, in press (types of *latulus*).

FAO Names : En - False herring.



Diagnostic Features : Tooth-plate on tongue and toothplate behind it (basihyal and basibranchial toothplates) broad, their width about 3 to 5 times in their combined length, the basibranchial toothplate with a distinct bulge in front. Lower gillrakers 28 to 34, usually 30 to 32. Scales fairly strongly attached, not easily lost. No dark pigment on dorsal fin tip. See CLUP Har 1, Fishing Area 31.



Geographical Distribution : Gulf of Mexico, southeastern Florida, Bahamas, entire Caribbean and West Indies and southward to Brazil.

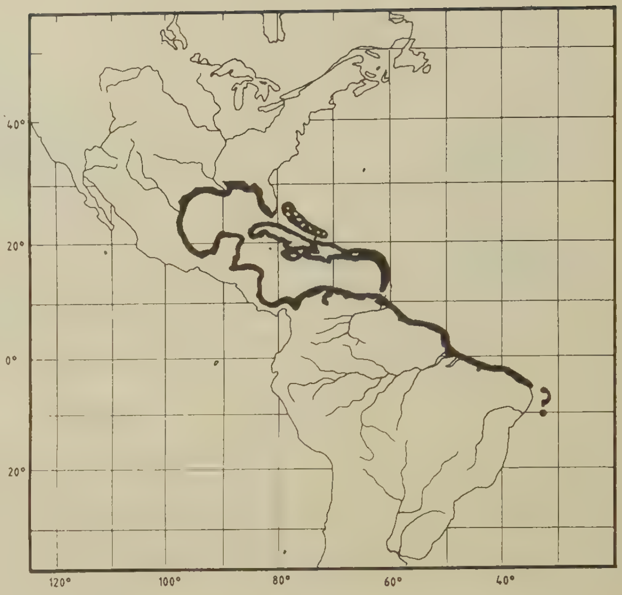
Habitat and Biology : Coastal, pelagic, estuaries and lagoons, tolerating quite low salinities, schooling, small individuals often occurring in numbers along sandy beaches.

Size : To 15 cm standard length, usually about to 10 cm.

Interest to Fisheries : Most frequently caught for bait with seines and cast nets in estuaries and bays (Rivas, 1950:292). Contributed to the 543 tons of the '*Harengula*' catch for 1983.

Local Names : USA: False pilchard (AFS list); see also FWNA (1964:390); VENEZUELA: Carapachona.

Literature : See under synonyms.



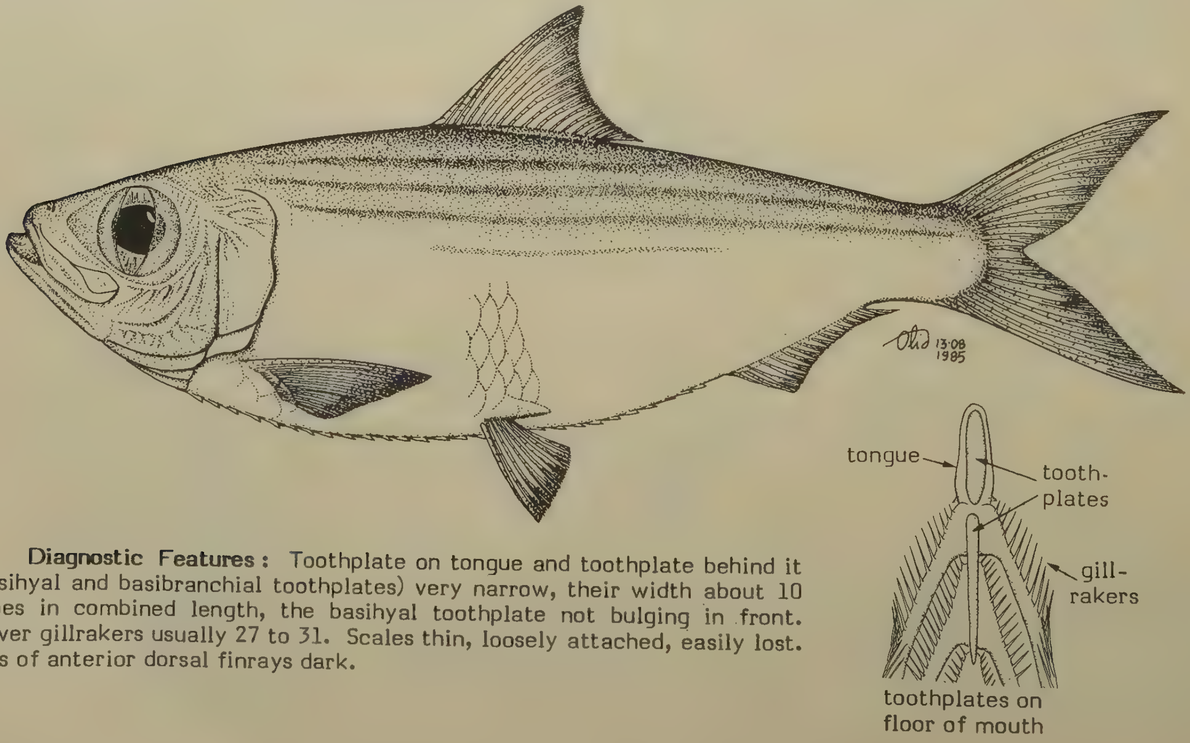
Harengula humeralis (Cuvier, 1829)

CLUP Har 3

Clupea humeralis Cuvier, 1829, *Règne anim.*, 2nd ed. **2**:318 (footnote, on *Sardine de la Martinique* of Duhamel, 1776, *Traité gén.pêches*, pt. 2 (3): pl. 31, fig. 4; reproduced by Storey, 1938: fig. 16).

Synonyms : *Harengula maculosa* Valenciennes, 1847:292 (Martinique); *Alosa apicalis* Müller & Troschel, 1847:675 (Barbados); *Harengula sardina* Poey, 1860:310 (Cuba); *Harengula callolepis* Goode, in Goode & Bean, 1879:152 (Bermuda); *Harengula humeralis* - Storey, 1938:28; Rivas, 1950:282; FWNA, 1964:387, fig. 95; Cervigón, 1966:122, fig. 51; Whitehead, 1967:27 (type: no types found for *H. maculosa*); *Idem*, 1973a:35, fig. 9 (Guianas); Whitehead & Bauchot, in press (type of *maculosa* lost).

FAO Names : En - Redear herring.



Diagnostic Features : Toothplate on tongue and toothplate behind it (basihyal and basibranchial toothplates) very narrow, their width about 10 times in combined length, the basihyal toothplate not bulging in front. Lower gillrakers usually 27 to 31. Scales thin, loosely attached, easily lost. Tips of anterior dorsal finrays dark.

Geographical Distribution : Bermuda, Florida, Bahamas, Caribbean, Guianas (but no records to the south of this; no Brazilian specimens in the extensive collections of the Museu de Zoologia, Sao Paulo, Brazil).

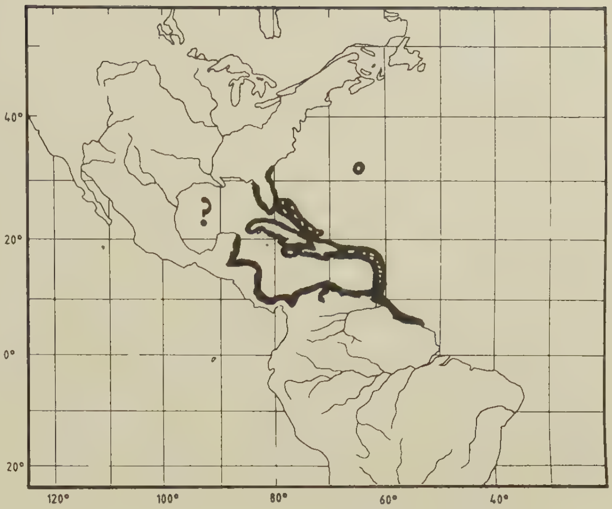
Habitat and Biology : Coastal, pelagic, schooling.

Size : To 17.2 cm standard length, usually about 10 cm.

Interest to Fisheries : Contributed to the 543 tons of the 'Harengula' catch for 1983.

Local Names : USA: See FWNA (1964:387); VENEZUELA: Manzanillera.

Literature : See under synonyms.



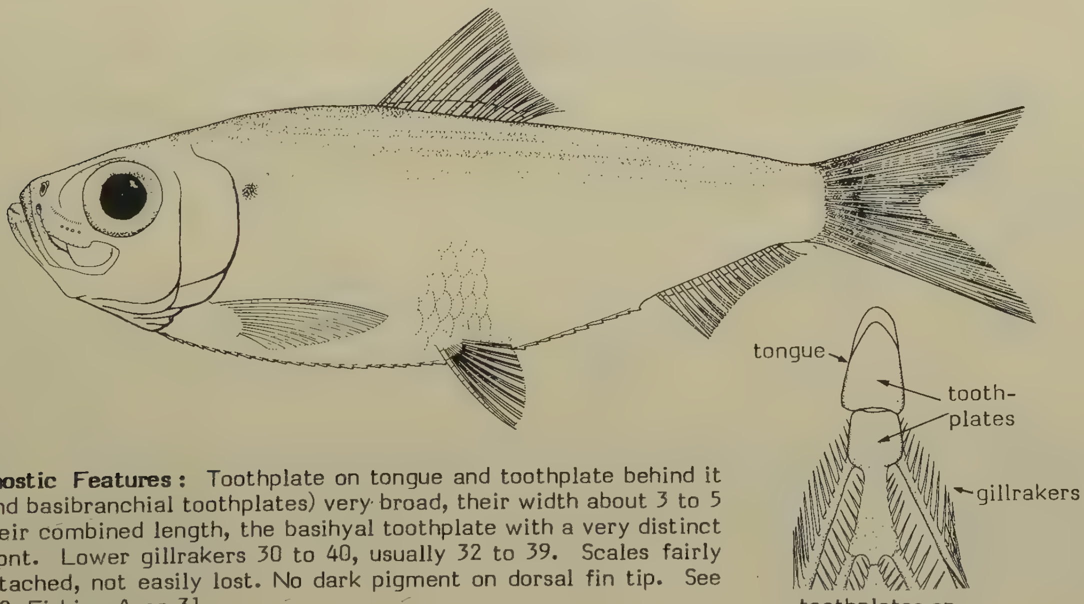
Harengula jaguana Poey, 1865

CLUP Har 2

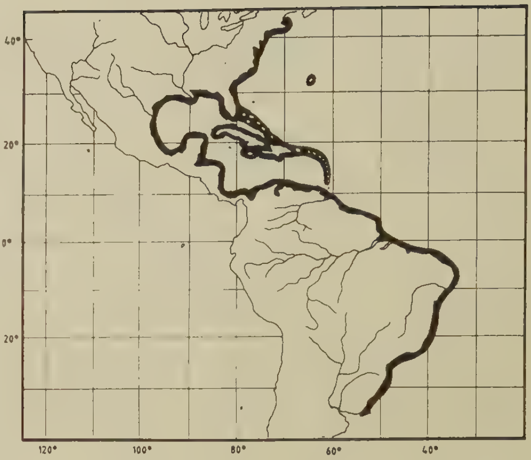
Harengula jaguana Poey, 1865, Repert.Fisico-Nat.Cuba, 1:189 (Bahía de Jaqua, Cuba).

Synonyms : Harengula humeralis Valenciennes, 1847:293 (St. Domingo, Surinam, Brazil; name preoccupied by Harengula humeralis (Cuvier, 1829), fide Whitehead, 1967:30); Harengula pensacolae Goode & Bean, 1879:152 (Pensacola, Florida); Storey, 1938:33; Rivas, 1950:292 (6 subspecies; see remarks); FWNA, 1964:393, fig. 97; Cervigón, 1966:125, fig. 53; Harengula majorina Storey, 1938:32; Hyrtlinus altiforma Fowler, 1958:6 (skeleton); Harengula jaguana - Whitehead, 1973a:41, fig. 11 (Guianas).

FAO Names : En - Scaled herring.



Diagnostic Features : Toothplate on tongue and toothplate behind it (basihyal and basibranchial toothplates) very broad, their width about 3 to 5 times in their combined length, the basihyal toothplate with a very distinct bulge in front. Lower gillrakers 30 to 40, usually 32 to 39. Scales fairly strongly attached, not easily lost. No dark pigment on dorsal fin tip. See CLUP Har 2, Fishing Area 31.



Geographical Distribution : New Jersey (USA), also Bermuda, southward to Florida, Gulf of Mexico (abundant), Caribbean to southern Brazil.

Habitat and Biology : Coastal, pelagic, schooling, perhaps also in estuaries and bays, but often confused with H. clupeola (with which it occurs over most of its range). Juveniles of 2.9 to 4.4 cm standard length appeared in Guanabara Bay, Rio de Janeiro, in May and migrated out in December or March at 7.5 to 8.0 cm (Hubold & Mazzetti, 1982). Breeds February to July (peak May and June) around Miami.

Size : To 15 cm standard length, usually to 12 cm.

Interest to Fisheries : Contributed to the 543 tons of the 'Harengula' catch for 1983.

Local Names : USA: Scaled sardine (AFS list); see also FWNA (1964:393).

Literature : Matsuura (1972 - as H. pensacolae, Brazil, eggs); Houde, Richards & Saksena (19 - eggs, larvae); Hubbold & Mazzetti (1982 - Brazil, juveniles).

Remarks : Rivas (1950:280, key) recognized the following 6 subspecies: pensacolae, majorina and his own proposed names floridana, caribbaea and pinensis. Subsequently (Rivas, 1963:395, i.e. FWNA) he accepted that these forms intergrade in their defining characters and separating on geographical grounds would be arbitrary. Nevertheless, specimens show differences in morphometric and meristic features over the rather extensive range of the species and at least some subspecies may eventually be recognized.

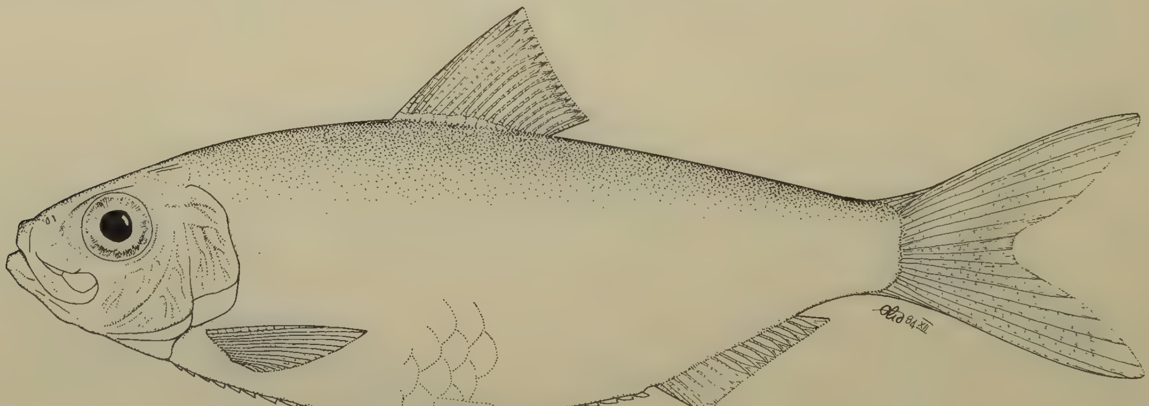
Harengula thrissina (Jordan & Gilbert, 1882)

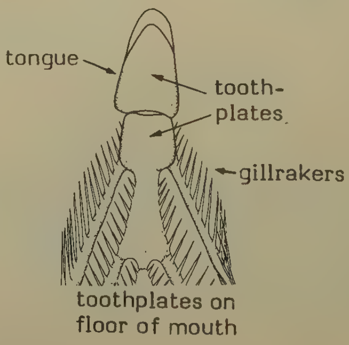
CLUP Har 4

Clupea thrissina Jordan & Gilbert, 1882, Proc.U.S.natn.Mus., 5:353 (Cape San Lucas, Mexico).

Synonyms : Harengula peruana Fowler & Bean, 1923:2 (Callao, Peru); Rivas, 1950:287, fig. 39; Peterson, 1956:177 (Gulf of Nicoya, Costa Rica); Harengula thrissina - Hildebrand, 1946:88 (Peru); Rivas, 1950:287 (Gulf of California to Acapulco, Mexico); FWNA, 1964:387 (key; peruana kept separate).

FAO Names : En - Pacific flatiron herring.





Diagnostic Features : Toothplate on tongue and toothplate behind it (basihyal and basibranchial toothplates) broad, their width about 3 to 5 times in their combined lengths. Lower gillrakers 28 to 34. Last dorsal finray not elongate (cf. Opisthonema); anal finrays 15 to 17 (cf. more than 30 in species of Pristigasteridae).

Geographical Distribution : Gulf of California to Peru (at least to Callao).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 8 cm standard length, usually to 5 cm.

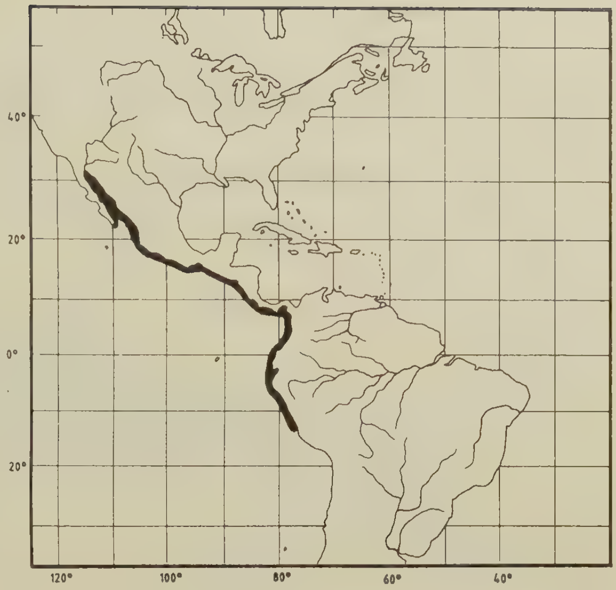
Interest to Fisheries : Probably little.

Local Names : USA: Flatiron herring (AFS list).

Literature : See under synonyms.

Remarks : Rivas (1950:286-7, also 1964:387, i.e. FWNA) recognized *H. peruana* as a distinct species, but it seems more likely a subspecies or perhaps merely a southern form:

H. thrissina thrissina: 42 to 44, usually 43 scales in lateral series, 15 to 19 pre-dorsal scales; Gulf of California to Panama
H. thrissina peruana: 38 to 42, usually 39 to 41 scales in lateral series, 11 to 14 pre-dorsal scales; Panama to Peru.



Opisthonema Gill, 1861

CLUP Opi

Opisthonema Gill, 1861, *Proc.Acad.nat.Sci.Philad.*:37 (type: *Opisthonema thrissa* Gill = *Megalops oglina* LeSueur). *Filialosa* Fowler, 1944, *Monagr.Acad.nat.Sci.Philad.*, (6):207 (type: *Meletta libertate* Günther).

Diagnostic Features : The filamentous last dorsal finray distinguishes *Opisthonema* from all other genera of the Clupeinae; it otherwise resembles *Sardinella* (but pelvic finrays i 7, cf. i 8 in all New World *Sardinella*) and *Harengula* (which has a small toothed hypo-maxilla between the hind tip of the pre-maxilla and the expanded blade of the maxilla). A filamentous last dorsal finray occurs in *Dorosoma* and certain other gizzard shads, but mouth inferior.

Biology, Habitat and Distribution : Marine, pelagic and schooling. New World only (Atlantic and Pacific coasts), mainly in tropical and subtropical waters.

Interest to Fisheries : Moderate catches of both Atlantic and Pacific species (45 745 tons combined in 1983).

Species : The most recent revision (Berry & Barrett, 1963), recognized 1 Atlantic and 4 Pacific species, to which Rivas (1972) added another Atlantic species (*O. captivai*) which is here considered merely a subspecies (see remarks):

O. oglinum (LeSueur, 1818), western Atlantic
O. berlangai Berry & Barrett, 1963, eastern Pacific
O. bulleri (Regan, 1904), eastern Pacific
O. libertate (Günther, 1867), eastern Pacific
O. medirastre Berry & Barrett, 1963, eastern Pacific.

Remarks : The 4 eastern Pacific species are only distinguished by numbers of lower gillrakers, which increase with size of fish; by excluding the Galapagos species (*O. berlangai*), there is little or no overlap in adult gillraker counts.

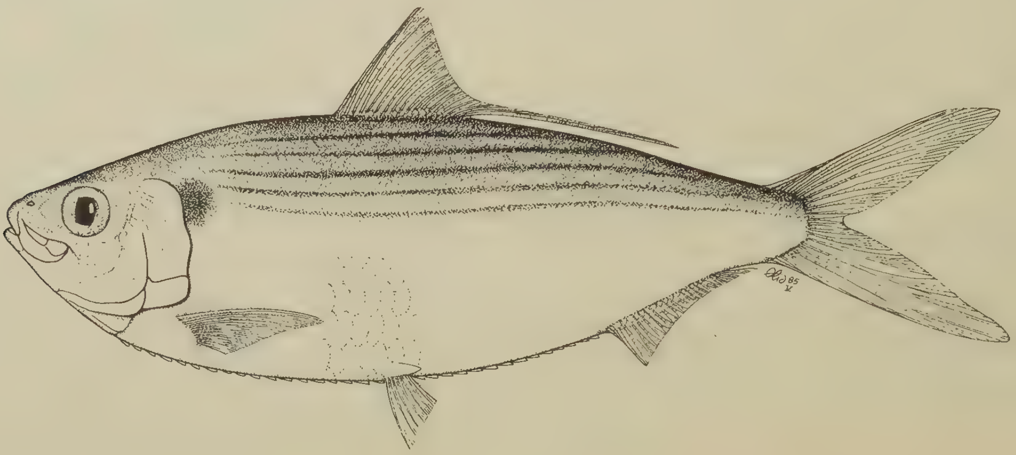
Opisthonema berlangai Berry & Barrett, 1964

CLUP Opi 2

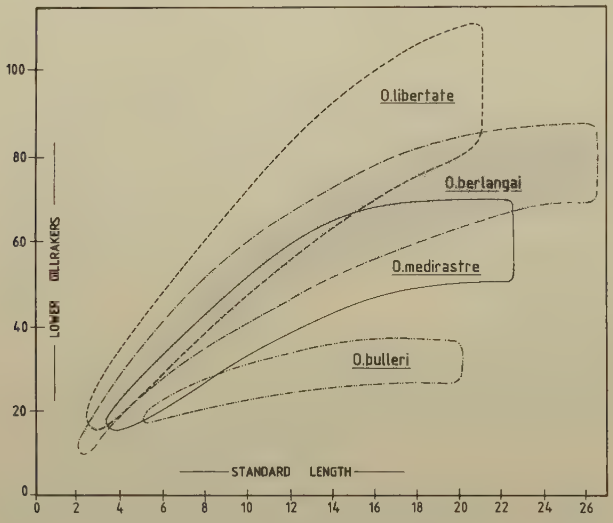
Opisthonema berlangai Berry & Barrett, 1964, Bull.inter-Am.trop.Tuna Comm., 7(2):119, fig. 1B (Galapagos Islands).

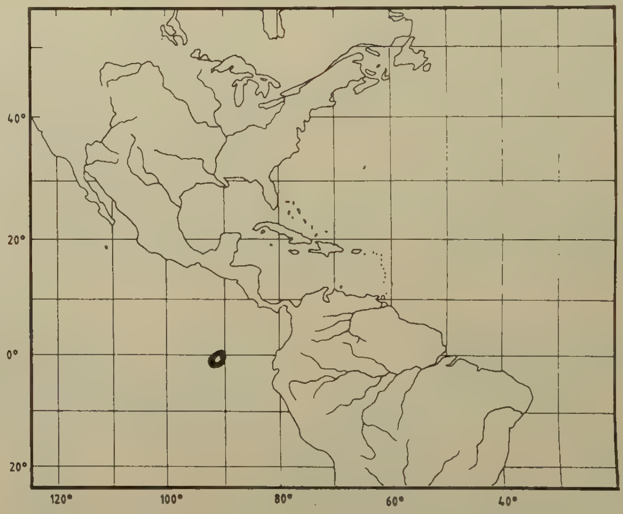
Synonyms : Opisthonema libertate: all Galapagos accounts.

FAO Names : En - Galapagos thread herring.



Diagnostic Features : The filamentous last dorsal finray distinguishes it from members of any other eastern Pacific clupeoid genus. Lower gillrakers 50 to 87 in fishes over 14 cm standard length (intermediate between O. medirastre with 41 to 69 and O. libertate with 63 to 110, but neither of these occur in the Galapagos Islands).





Geographical Distribution : Galapagos Islands only.

Habitat and Biology : Coastal, pelagic, schooling.

Size : To 26 cm standard length, usually to 18 cm.

Interest to Fisheries : Of little interest.

Local Names : Not distinguished from other eastern Pacific species.

Literature : Berry & Barrett (1964 - taxonomy only).

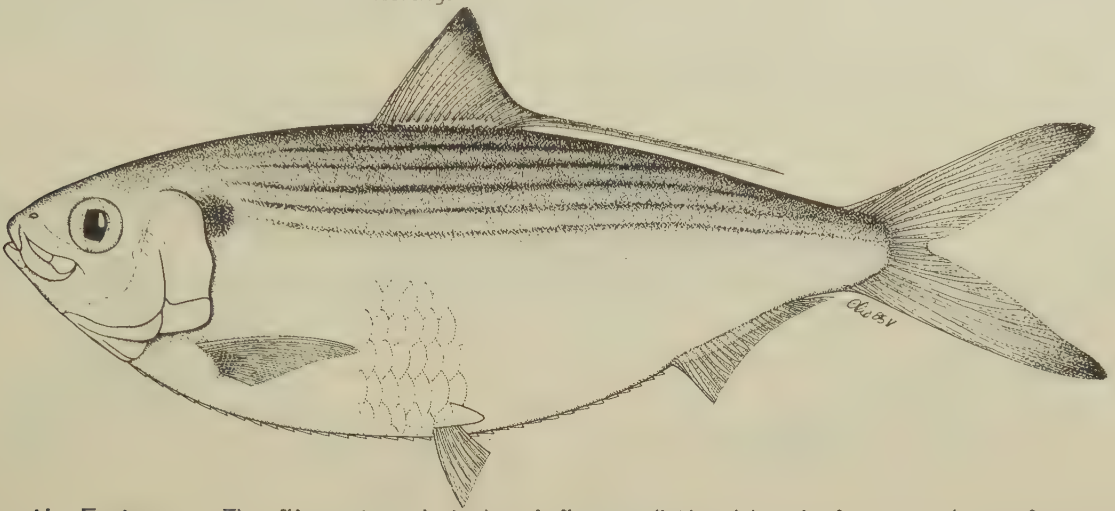
Opisthonema bulleri (Regan, 1904)

CLUP Opi 3

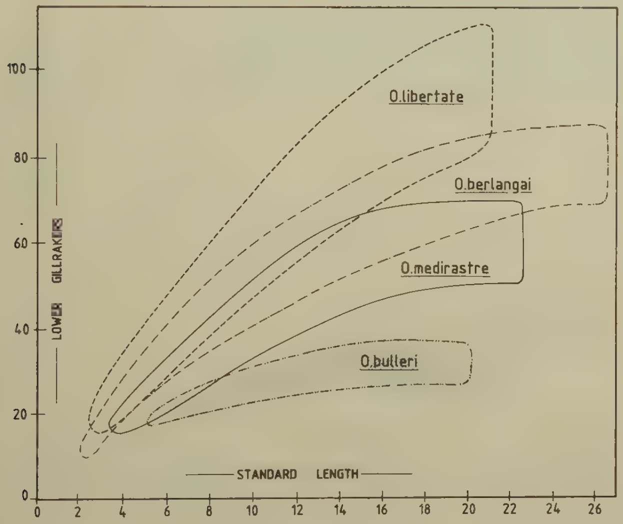
Clupea (Opisthonema) bulleri Regan, 1904, Ann.Mag.nat.Hist., (7)8:255 (Las Peñas (Puerto Vallarta), Jalisco, Mexico - but mixed with a specimen of O. libertate).

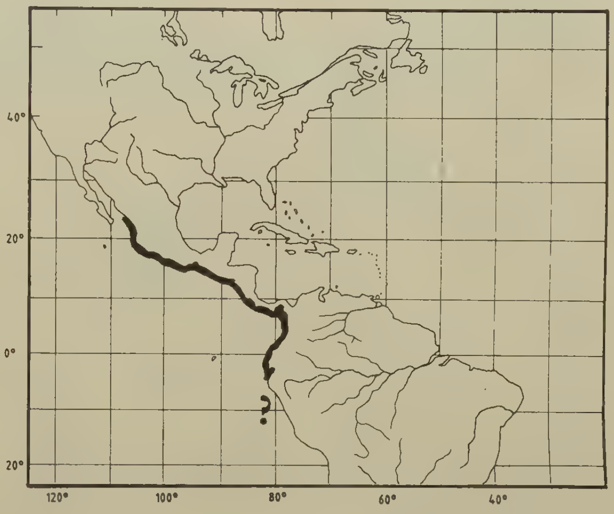
Synonyms : Probably included in at least some accounts of O. libertate.

FAO Names : En - Slender thread herring.



Diagnostic Features : The filamentous last dorsal finrays distinguishes it from members of any other eastern Pacific genus. Separated from other eastern Pacific Opisthonema by having only 25 to 36 lower gillrakers in fishes over 14 cm standard length (41 to 69 in O. medirastre, 63 to 110 in O. libertate; in O. berlangai there are 50 to 87 and it occurs only in the Galapagos Islands.





Geographical Distribution : Eastern Pacific (Mazatlan, Sinaloa, Mexico southward to Pta Sal and Pta Picos, Peru).

Habitat and Biology : Coastal, pelagic, schooling. Apparently the least abundant of the eastern Pacific species of Opisthonema. Feeds on crustaceans and pteropods.

Size : To 19.6 cm standard length, usually to 18 cm.

Interest to Fisheries : Presumably contributes to the total Opisthonema catch in the eastern Pacific of 40 081 tons in 1983.

Local Names : Not distinguished from other eastern Pacific species.

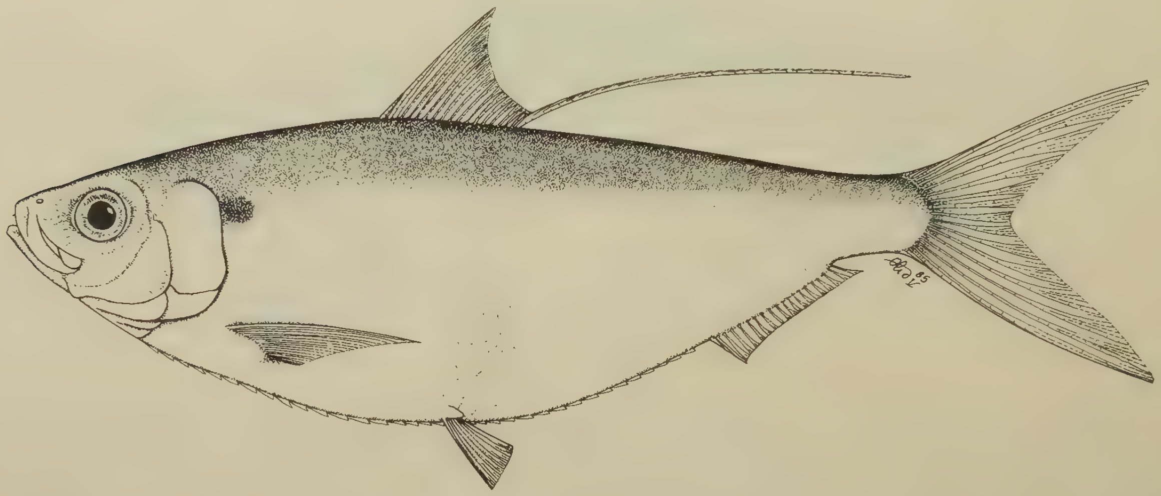
Literature : Berry & Barret (1964 - taxonomy), otherwise uncertain since not separated from O. libertate.

Opisthonema libertate (Günther, 1867)

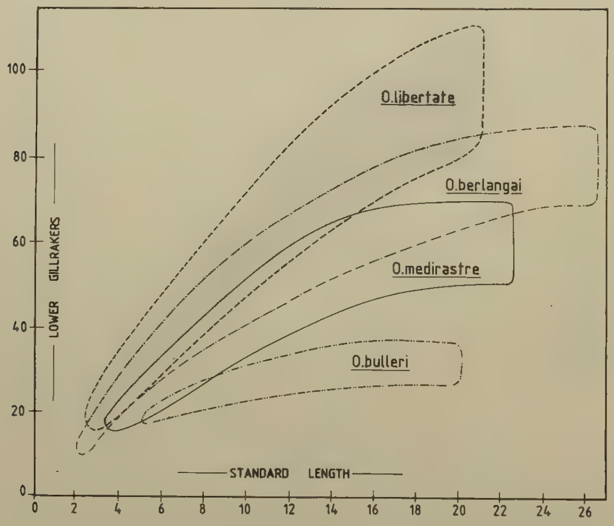
Meletta libertatis Günther, 1867, Proc.zool.Soc.Lond., (3):603 (La Libertad, El Salvador; part 3 issued April 1867, not in 1866).

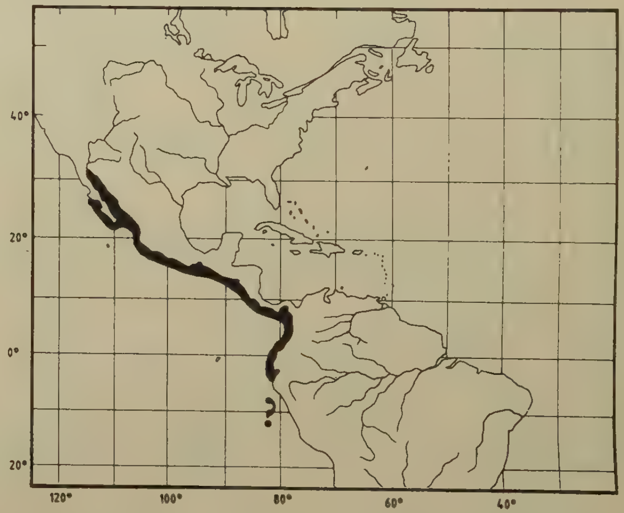
Synonyms : Opisthonema libertate - Berry & Barrett, 1964:120, fig. 1c (full synonymy; references to O. berlangai, O. bulleri and O. medirastre exluded); Cobo & Massey, 1949:7, fig. 5 (Ecuador, listed); Peterson, 1956:178 (Gulf of Nicoya, Costa Rica); Chirichigno, 1963:14, fig. 6 (Puerto Pizarro and Puerto Rico, Peru).

FAO Names : En - Pacific thread herring.



Diagnostic Features : The filamentous last dorsal finray distinguishes it from members of any other eastern Pacific clupeoid genus. Separated from other eastern Pacific Opisthonema species by having 63 to 110 lower gillrakers in fishes over 14 cm standard length (41 to 69 in O. medirastre, only 25 to 36 in O. bulleri; in O. berlangai there are 50 to 87, but it occurs only in the Galapagos Islands.





Geographical Distribution : Eastern Pacific (Santa Rosalita, Pacific coast of Baja California, Mexico, southward to Pta Sal and Pta Picos, Peru).

Habitat and Biology : Coastal, pelagic, schooling. Apparently the most abundant of the eastern Pacific species of Opisthonema. Feeds on crustaceans and pteropods.

Size : To 25 cm standard length, usually 12 to 18 cm.

Interest to Fisheries : Of some importance as a live bait until introduction of purse seines for tuna. Contributed to the total Opisthonema catch in the eastern Pacific of 40 481 tons in 1983 (the major part from Ecuador).

Local Names : See Cervigón & Fischer (1979).

Literature : Berry & Barrett (1964 - taxonomy only); earlier works probably combined data for O. bulleri and O. medirastre, e.g. Peterson (1956 - biol., etc.).

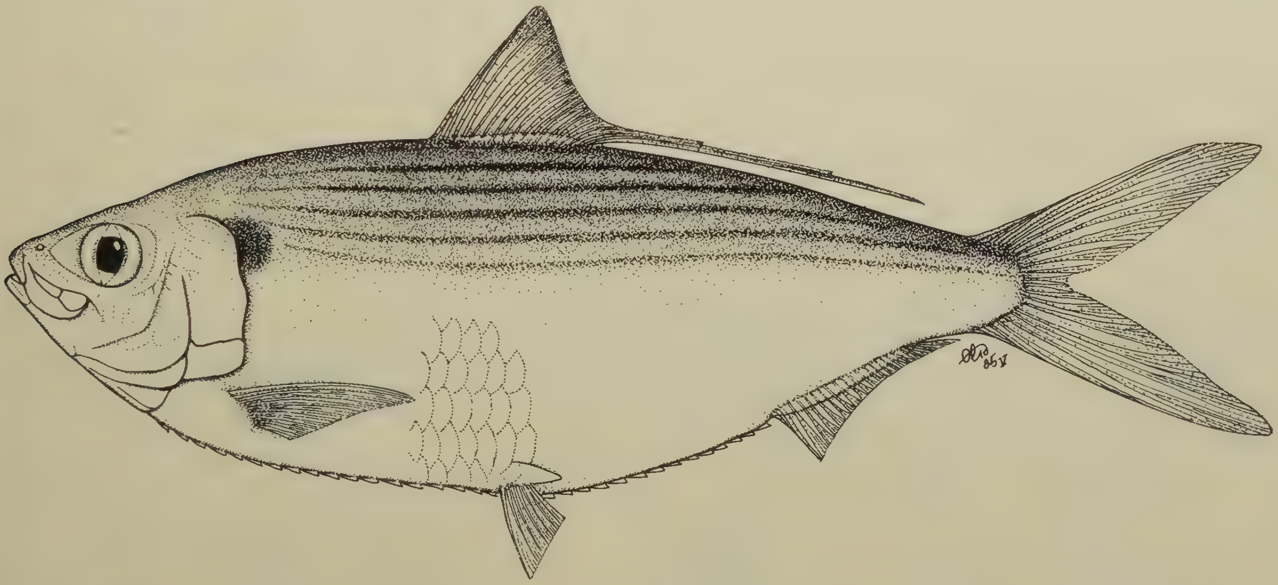
Opisthonema medirastre Berry & Barrett, 1964

CLUP Opi 5

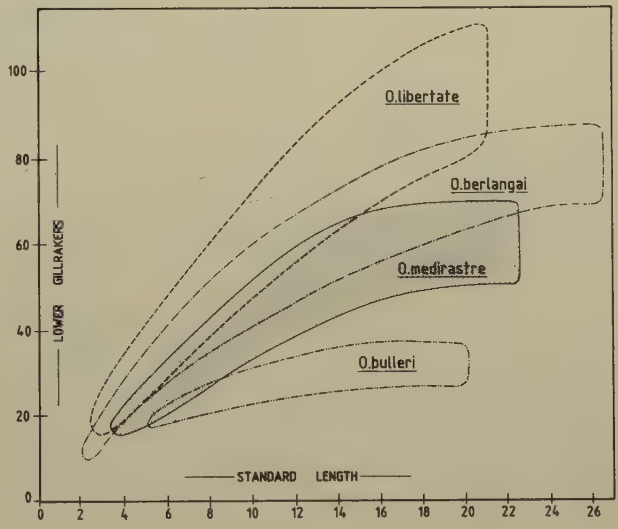
Opisthonema medirastre Berry & Barrett, 1964, Bull.inter-Am.trop.Tuna Comm., 7(2):118, fig. 1a (Gulf of Panama, also various localities from Los Angeles to Sechura Bay, Peru).

Synonyms : Included in at least some accounts of O. bulleri and especially O. libertate (the only Pacific species formerly recognized).

FAO Names : En - Middling thread herring.



Diagnostic Features : The filamentous last dorsal finray distinguishes it from members of any other eastern Pacific clupeoid genus. Separated from other eastern Pacific Opisthonema by having 41 to 69 lower gillrakers in fishes over 14 cm standard length (63 to 110 in O. libertate, only 25 to 36 in O. bulleri; in O. berlangai there are 50 to 87, but it occurs only in the Galapagos Islands.



Geographical Distribution : Eastern Pacific (Los Angeles Bay, California southward to Sechura Bay, Peru).

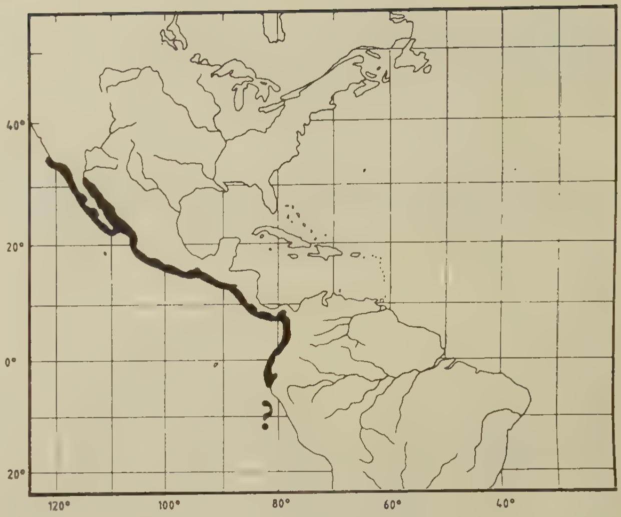
Habitat and Biology : Coastal, pelagic, schooling. Feeds on crustaceans and pteropods.

Size : To 22 cm standard length, usually 15 to 20 cm.

Interest to Fisheries : Of some importance as a live bait until introduction of purse seines for tuna. Contributed to a total *Opisthonema* catch in the eastern Pacific of 40 481 tons in 1983.

Local Names : Not distinguished from the other eastern Pacific species.

Literature : Uncertain since not separated from *O. libertate*.



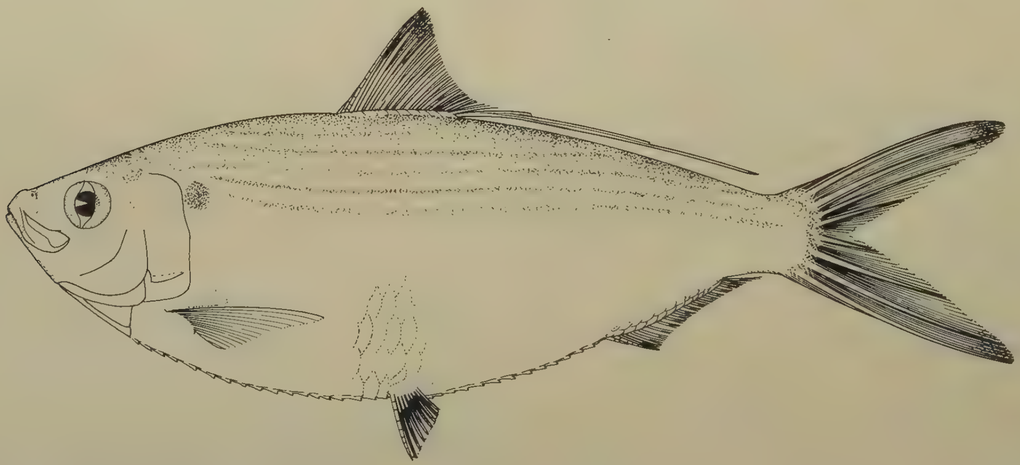
Opisthonema oglinum (LeSueur, 1818)

CLUP Opi 1

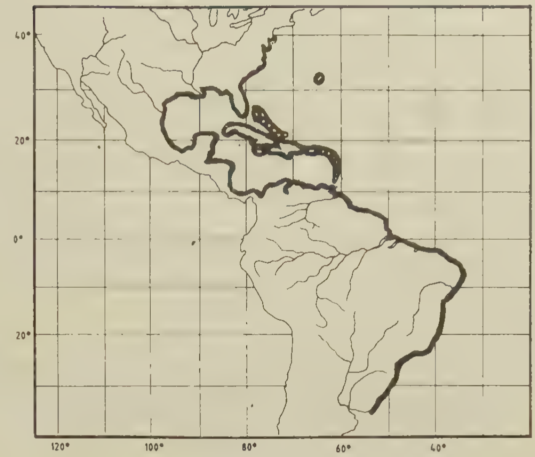
Megalops oglinum LeSueur, 1818, J.Acad.nat.Sci.Philad., **1**:359 (Newport, Rhode Island).

Synonyms : *Megalops notata* LeSueur, 1818:361 (Guadeloupe); *Chatoessus signifer* DeKay, 1842:264, pl. 41, fig. 132 (New York); *Meletta thrissa* Valenciennes, 1847:380 (New York, Santo Domingo, Guadeloupe, Martinique; not *Clupea thrissa* Linnaeus, 1758); *Alausa striata* Valenciennes, 1847:429 (Guadeloupe); *Chatoessus eumorphus* Gosse, 1851: 290 (Jamaica); *Opisthonema captivai* Rivas, 1972: (Colombia); *Opisthonema oglinum* - FWNA, 1964:381, fig. 94; Berry & Barrett, 1964:123 (revision); Cervigón, 1966:118, fig. 49; Whitehead, 1967:73, 75 (types of *A. striata*, *M. thrissa*); *Idem*, 1973:46, fig. 12 (Guianas); Figueiredo & Menezes, 1978:22, fig. 25; Whitehead & Bauchot, in press (type of *notata thrissa*).

FAO Names : En - Atlantic thread herring.



Diagnostic Features : The filamentous last dorsal finray distinguishes it from all other western Atlantic clupeoids except *Dorosoma*, which has an inferior mouth. Otherwise, superficially resembles species of *Sardinella* (but i 8 pelvic finrays in western Atlantic species, cf. i 7 in *Opisthonema*) and *Harengula* (but small toothed hypomaxilla in upper jaw). Lower gillrakers increasing initially with size of fish, but stable at 28 to 46 after 8 cm standard length.



Geographical Distribution : Western Atlantic (Gulf of Maine, Bermuda, throughout Gulf of Mexico, Caribbean and West Indies to Santa Caterina, Brazil).

Habitat and Biology : Coastal, pelagic, schooling (but solitary individuals reported), probably not entering water of low salinity. Feeds by filtering plankton (copepods), but also takes small fishes, crabs and shrimps. Breeds in May-June off North Carolina, possibly March-July off Venezuela.

Size : To 25 cm standard length, usually to 20 cm.

Interest to Fisheries : Although locally abundant, not greatly valued for food although appearing in markets (West Indies, Panama). The total catch was 5 264 tons in 1983 (mostly USA, Cuba and Venezuela).

Local Names : BRAZIL: Sardinha bandeira; USA: See FWNA (1964:381).

Literature : Berry & Barrett (1964 - full revision, but almost no biological data); other references under synonyms, again with rather little data on food and breeding).

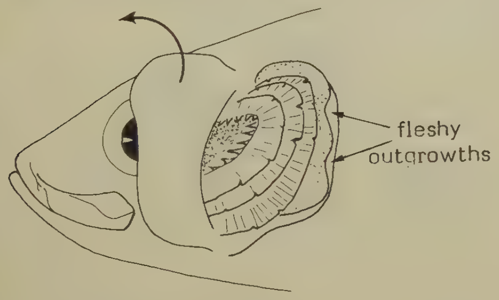
Remarks : Rivas (1972) distinguished a Colombian form as a distinct species, which he claimed occurred with *O. oglinum*, but the distinguishing characters mostly overlap or are very close; possibly this is a subspecies:

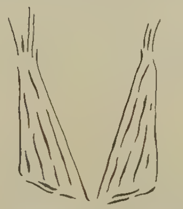
O. oglinum oglinum: body deeper, 32 to 37% of standard length; more lower gillrakers, 30 to 37; more dorsal and anal finrays, 19 to 22 and 22 to 25; fewer scales, 32 to 35; Gulf of Maine to Brazil, but not Colombia.
O. oglinum captivai: body more slender, 27.9 to 31.1% of standard length; fewer lower gillrakers, 25 to 28; fewer dorsal and anal finrays, 19 or 20 and 18 to 21; more scales, 34 to 37; Colombia only.

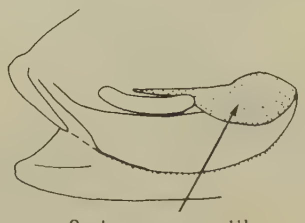
Herklotsichthys Whitley, 1951

CLUP Herk

Herklotsella Fowler, 1934, *Proc.Acad.nat.Sci.Philad.*, **85**:246 (type: *Herengula dispilonotus* Bleeker) (not *Herklotsella* Herre, 1933 - a siluroid genus). *Herklotsichthys* Whitley, 1951, *Proc.R.zool.Soc.N.S.W.*, (1949-50):67 (type: *Harengula dispilonotus* Bleeker; replacement name since *Herklotsella* preoccupied). *Harengula*: Fowler, 1941:584 (adopted by numerous authors until *Harengula* Valenciennes was finally restricted to New World species).




fronto-parietal
striae on top
of head



Diagnostic Features : The presence of two fleshy outgrowths on the hind margin of the gill opening distinguishes *Herklotsichthys* from all other clupeoid genera except *Harengula* and *Opisthonema* (both restricted to New World; also characterized by a toothed hypo-maxilla and a filamentous last dorsal finray respectively) and *Sardinella* and *Amblygaster* of which some species closely resemble *Herklotsichthys*, but have more fronto-parietal striae on top of head (7 to 14; cf. 3 to 7), a symmetrical second supra-maxilla (cf. lower part larger than upper) and the last two anal finrays enlarged.

Biology, Habitat and Distribution : Marine pelagic and schooling, but some Australian species apparently entering freshwater, or at least estuaries. Indo-Pacific region only, mainly in tropical or subtropical waters. Earlier biological studies are of limited value because of poor taxonomy.

Species : In the most recent revision, Wongratana (1980) recognized 8 species and subsequently described 2 of these as new (Wongratana, 1983). Further studies on the Australian *Herklotsichthys* increases the total known species to 12 (of which 3 Australian species have yet to be named):

Widespread

H. quadrimaculatus (Rüppell, 1837), Indo-West Pacific

Western Indian Ocean

H. lossei Wongratana, 1983, the "Gulf"
H. punctatus (Rüppell, 1837), Red Sea.
H. spilurus (Guichenot, 1863), East Africa, Réunion Island.

Western Central Pacific

H. dispilonotus Bleeker, 1852, Indonesia, Gulf of Thailand

Australia

H. blackburni (Whitley, 1948), western Australia
H. castelnaui (Ogilby, 1897), eastern Australia
H. gotoi Wongratana, 1983, northern Australia, New Guinea
H. koningsburgeri (Weber & de Beaufort, 1912), western Australia.
Herklotsichthys Species A, western Australia
Herklotsichthys Species B, western Australia
Herklotsichthys Species C, eastern Australia.

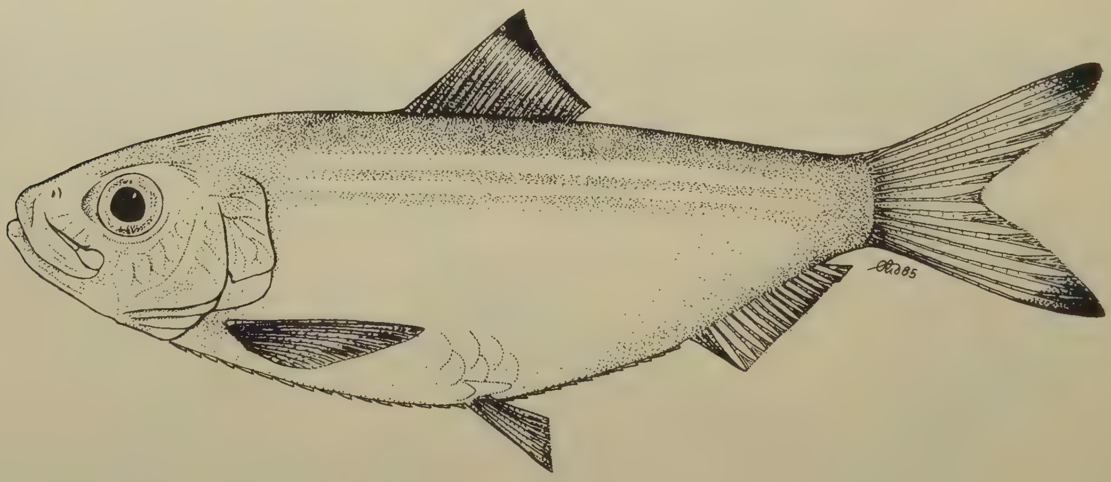
Herklotsichthys blackburni (Whitley, 1948)

CLUP Herk 6

Macrura blackburni Whitley, 1948, *Aust.Zool.*, **11**:266 (Port Hedland, Western Australia).

Synonyms : *Harengula blackburni*:Munro, 1956:23 fig. 163 (Port Hedland, Western Australia).

FAO Names : En - Blackburn's herring.



Diagnostic Features : Body moderately deep, its depth 30% of standard length of more. Distinguished from most other Australian *Herklotsichthys* by lacking spots on the flank (*H. koningsbergeri*, *Herklotsichthys* Species A) and lacking elongate wing-like scales underneath the normal paired pre-dorsal scales (the previous two species, also *H. quadrimaculatus* and *Herklotsichthys* Species B). Most closely resembles *H. castelnaui* of eastern Australia, but has fewer lower gillrakers (38 to 42; cf. 42 to 47, 51 or 52). Separated from *H. gotoi* and *Herklotsichthys* Species C (neither found in Western Australia) by its black tips to caudal fin (cf. at most grey) and three distinct dark lines along upper flank.

Geographical Distribution : Western Australia (Port Hedland, Onslow).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

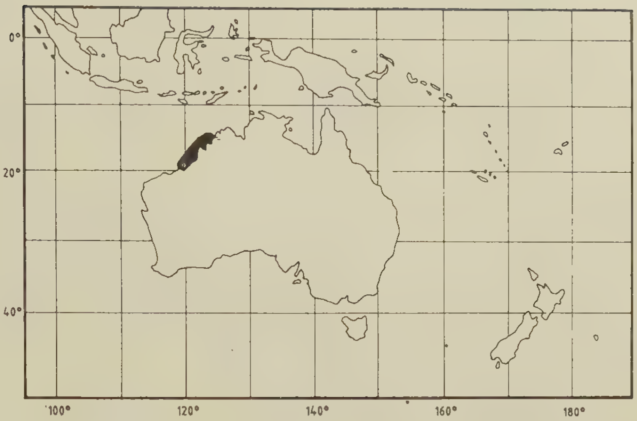
Size : To 10.5 cm standard length, usually about 8 cm.

Interest to Fisheries : No separate statistics.

Local Names : AUSTRALIA: Blackburn's yellowfin herring (Munro, 1965).

Literature : See under synonyms.

Remarks : The western counterpart of H. castelnaui and possibly merely a subspecies.



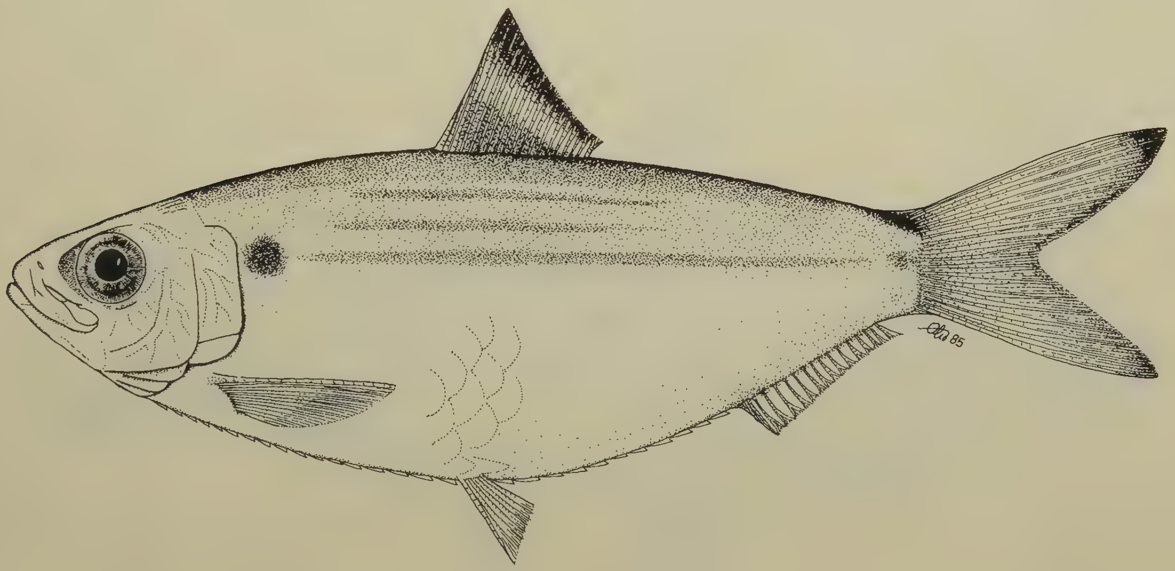
Herklotsichthys castelnaui (Ogilby, 1897)

CLUP Herk 7

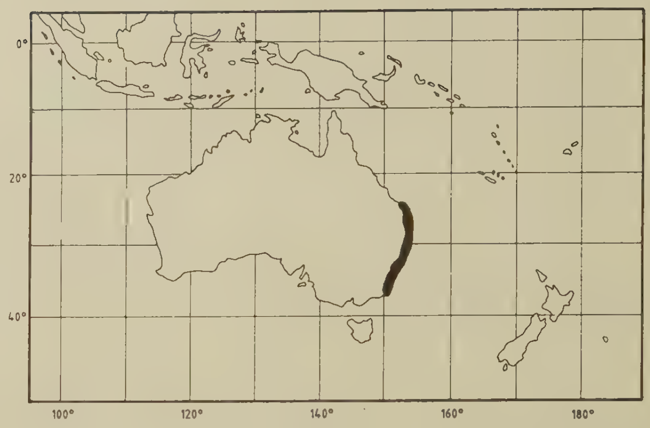
Kowala castelnaui Ogilby, 1897, Proc.Linn.Soc.N.S.W., **22**:66 (New South Wales).

Synonyms : Harengula abbreviata:Munro, 1956:24, fig. 164 (not Harengula abbreviata Valenciennes, 1847, which is considered a nomen dubium by Whitehead, 1967:69); Herklotsichthys castelnaui - Wongratana, 1981:145, pls 89, 90 (but excluding the specimens of H. blackburni).

FAO Names : En - Castelnau's herring.



Diagnostic Features : Body moderately deep, its depth 30% of standard length or more. Distinguished from most other Australian Herklotsichthys by lacking spots on the flank (H. koningsbergeri, Herklotsichthys Species A) and lacking elongate wing-like scales underneath the normal paired pre-dorsal scales (the previous two species, also H. quadrimaculatus and Herklotsichthys Species B). Most closely resembles H. blackburni of Western Australia, but has more lower gillrakers (42 to 47, some specimens 51 or 52; cf. 38 to 42). Separated from H. gotoi and Herklotsichthys Species C by having three distinct dark lines along upper flank (also, lower gillrakers only 34 to 38 in H. gotoi). Upper caudal tip black, dorsal fin with distinct pale band separating grey base from black tip; a dark line along upper edge of caudal peduncle.



Geographical Distribution : Eastern Australia (Queensland southward to New South Wales).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 14 cm standard length, usually to 10 cm.

Interest to Fisheries : No separate statistics.

Local Names : AUSTRALIA: Southern herring (Munro, 1956).

Literature : See under synonyms.

Remarks : Possibly is merely an eastern subspecies, of which H. blackburni is the western counterpart; however, it seems equally close to Herklotsichthys Species C.

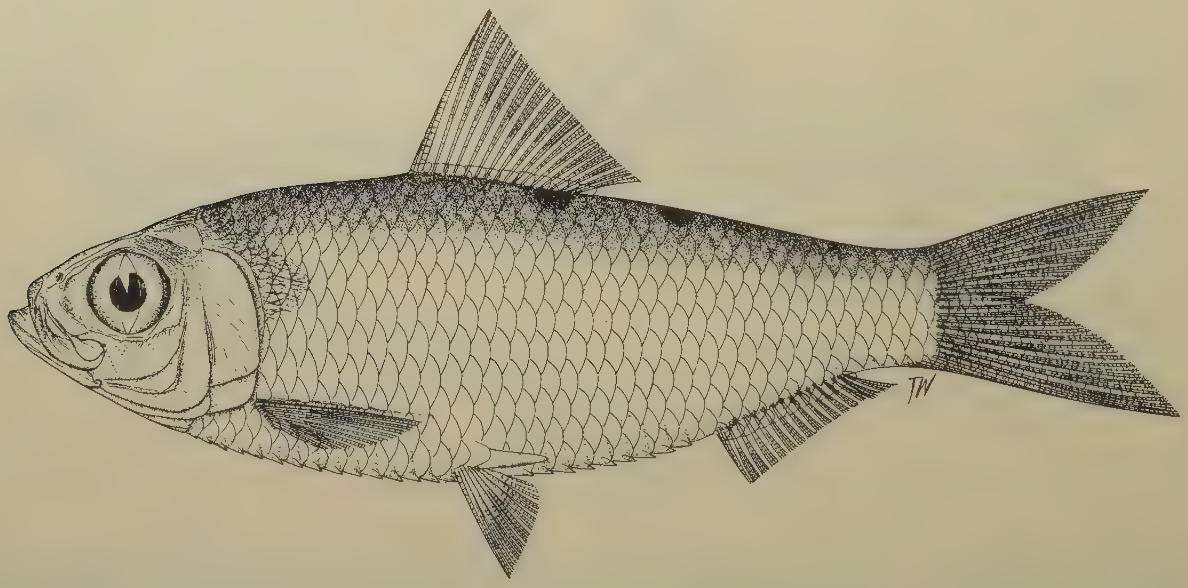
Herklotsichthys dispilonotus (Bleeker, 1852)

CLUP Herk 5

Harengula dispilonotus Bleeker, 1852, Natuurk.Tijdschr.Ned.-Indië, **3**:456 (Banka, Indonesia).

Synonyms : Harengula dispilonotus:Fowler, 1941:585 (full synonymy); Herklotsichthys dispilonotus: Wongratana, 1981:151, pls 98, 99 (description, illustrations).

FAO Names : En - Blacksaddle herring.



Diagnostic Features : Body moderately deep, its depth 30 to 35% of standard length. Immediately distinguished from all other species of Herklotsichthys by the presence of two dark saddle-like blotches on the back, at the hind part of the dorsal fin base and a short distance behind this. Overlaps range of H. quadrimaculatus, which lacks the black saddles and has elongate wing-like scales underneath the normal paired pre-dorsal scales.

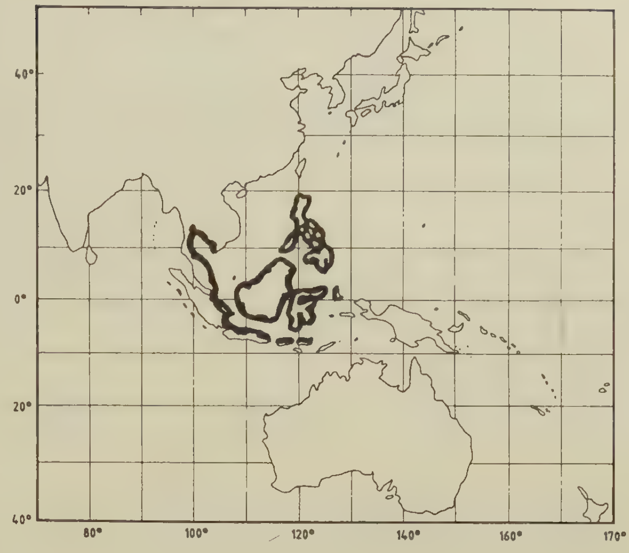
Geographical Distribution : Gulf of Thailand, the Philippines, Indonesia (not eastern Indian Ocean).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 8.5 cm standard length, usually to 7 cm.

Interest to Fisheries : No separate statistics; enters artisanal fisheries, but uncommon.

Local Names : -



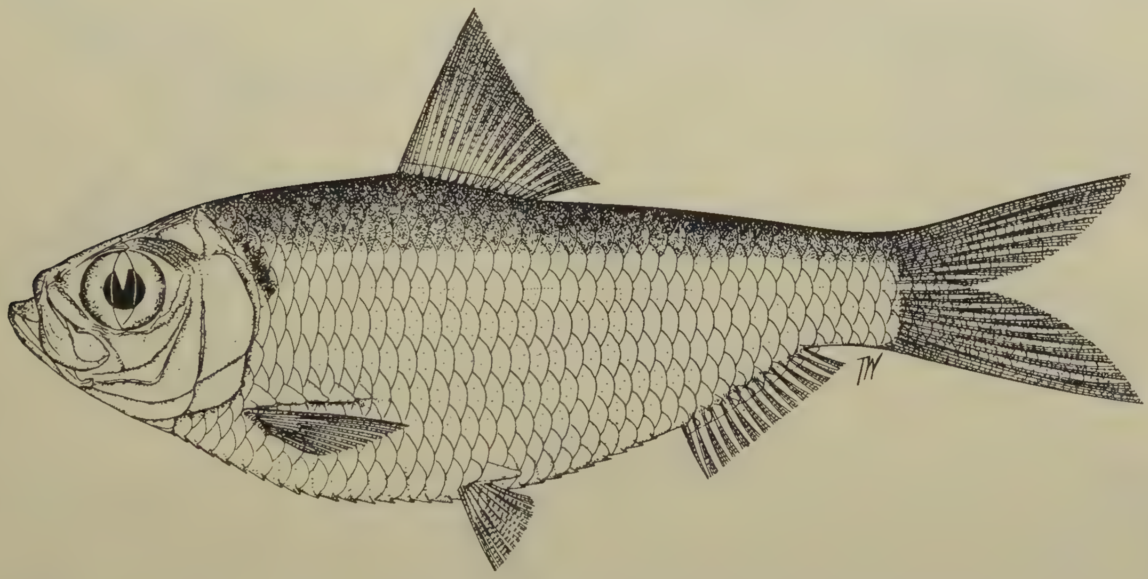
Herklotsichthys gotoi Wongratana, 1983

CLUP Herk 8

Herklotsichthys gotoi Wongratana, 1983, *Jap.J.Ichthyol.*, **29**(4):391, fig. 6 (Mimiko R., Papua New Guinea).

Synonyms : None.

FAO Names : En - Goto's herring.



Diagnostic Features : Body moderately deep, its depth 38 to 41% of standard length. Distinguished from most other Australian *Herklotsichthys* by lacking spots on the flank, except for a single dark spot behind gill cover (*H. koningsbergeri*, *Herklotsichthys* Species A) and lacking elongate wing-like scales underneath the normal paired pre-dorsal scales (the previous two species, also *H. quadrimaculatus* and *Herklotsichthys* Species B). Resembles *H. blackburni* and *H. castelnaui*, but lacks the three distinct dark lines along upper flank (also only 34 to 38 lower gillrakers; cf. 38 to 42 and 41 to 51). Distinguished from *Herklotsichthys* Species C by the fewer gillrakers (cf. 45 to 48), presence of a dark spot behind the gill cover, but no dark tip to dorsal fin.

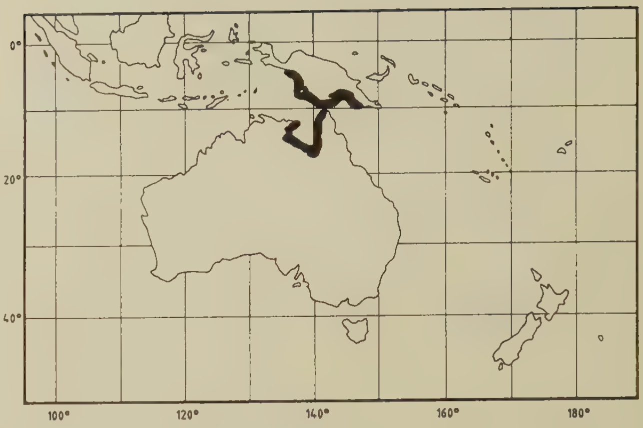
Geographical Distribution : New Guinea (Mimika River) and northern Australia (Gulf of Carpenteria).

Habitat and Biology : Coastal, pelagic, schooling; appears to enter estuaries, if not to ascend some way up rivers. More data needed.

Size : To at least 9 cm standard length, usually to 8 cm.

Interest to Fisheries : Possibly enters artisanal fisheries, but does not appear to be common.

Local Names : -



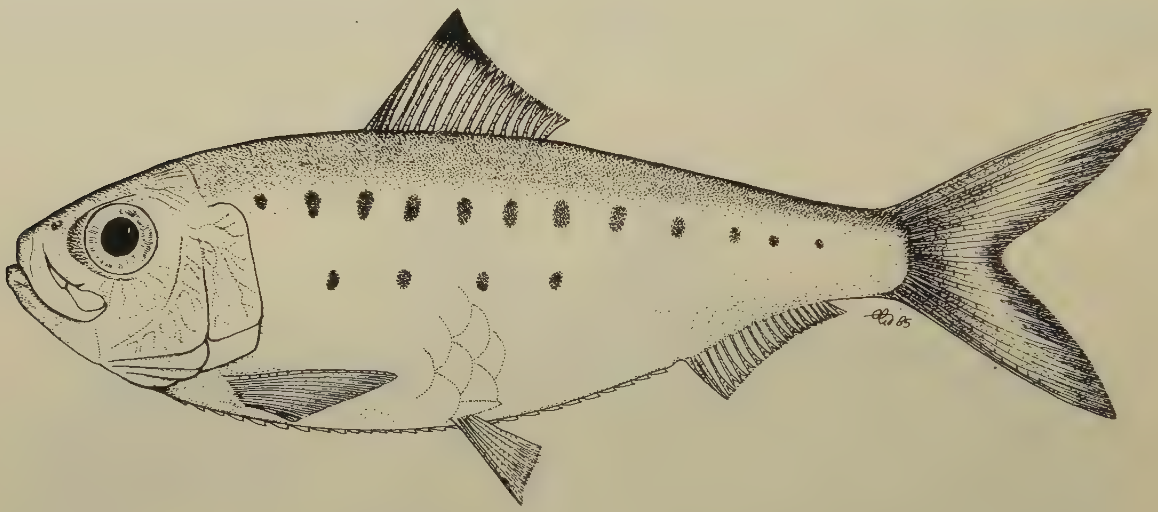
Herklotsichthys koningsbergeri (Weber & de Beaufort, 1912)

CLUP Herk 9

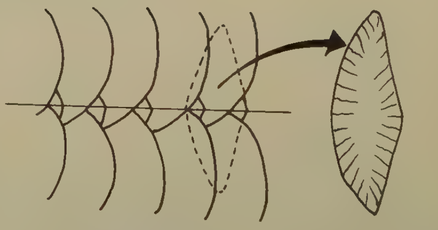
Clupea (*Harengula*) *koningsbergeri* Weber & de Beaufort, 1912, Verhand.Akad, *Wet.Amst.*, **17**:14 (Aru Island).

Synonyms : *Harengula maccullochi* Whitley, 1931:143, fig. 2 (Port Hedland, Western Australia); Munro, 1956:23, fig. 162.

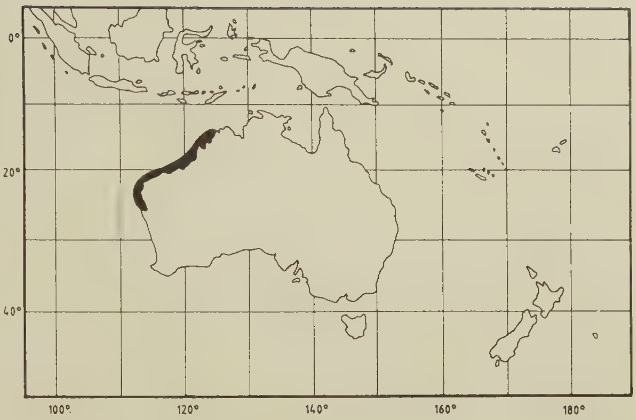
FAO Names : En - Koningsberger's herring.



Diagnostic Features : Body fairly deep, its depth 37 to 40% of standard length. Distinguished from all other Australian *Herklotsichthys* by the series of large and almost oval black spots on the flank, sometimes with a second partial row below. *Herklotsichthys* Species A has much smaller, round spots and is more slender, its depth 29 to 35% of standard length; also, hind edges of its scales are not denticulated and lower gillrakers 33 to 36; cf. 28 to 31 in *H. koningsbergeri*. Elongate wing-like scales present underneath normal paired pre-dorsal scales.



Geographical Distribution : Western Australia (Carnarvon to about Broome).



Habitat and Biology : Coastal, pelagic, schooling; enters inlets and lower reaches of rivers (Munro, 1956:23). More data needed.

Size : To 13 cm standard length, usually to 10 cm.

Interest to Fisheries : No separate statistics; perhaps not sufficiently abundant.

Local Names : AUSTRALIA: McCulloch's herring (Munro, 1956).

Literature : Munro (1956 - as H. maccullochi, description, brief notes).

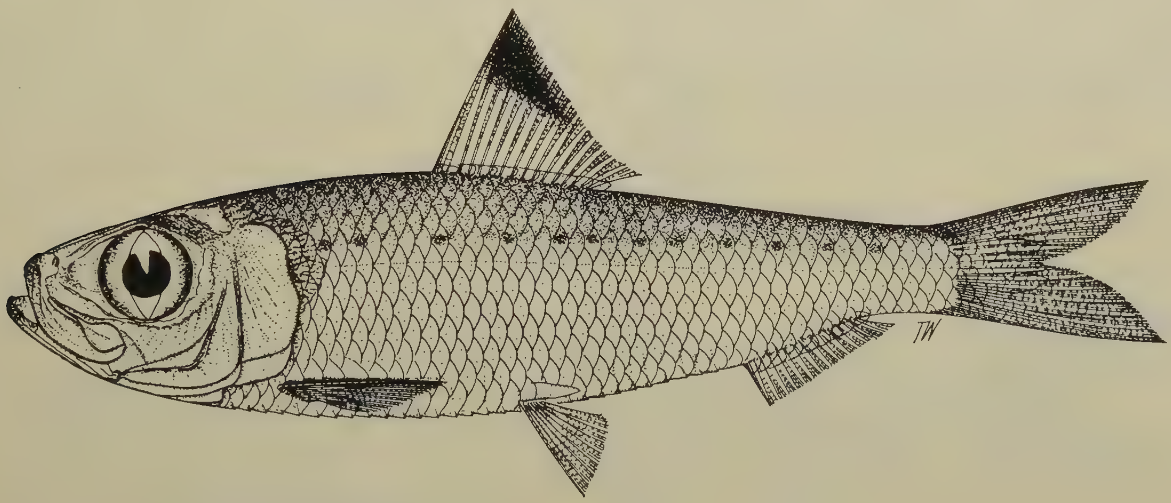
Herklotsichthys lossei Wongratana, 1983

CLUP Herk 3

Herklotsichthys lossei Wongratana, 1983, Jap.J.Ichthyol., **29**(4):392, fig. 7 (the "Gulf").

Synonyms : Sardinella melanura:Blegvad & Løppenthin, 1944:66 (the "Gulf"); Fowler, 1956:67 (same); Herklotsichthys punctatus:Whitehead, 1965:244 (the "Gulf" material only).

FAO Names : En - Gulf herring.



Diagnostic Features : Body slender, its depth 26 to 28% of standard length. Closely resembles H. punctatus of the Red Sea in shape, but the latter lacks a dark blotch on the dorsal fin and has small dark spots along the back (either side of dorsal fin) and not on the flank. Distinguished from H. spilurus (east African coast) by its more slender body (cf. depth 28 to 35% of standard length) and spots along flank. Possibly overlaps range of H. quadrimaculatus, which lacks spots on the flank and has elongate wing-like scales underneath the normal paired pre-dorsal scales. Flank with small dark spots, tip of dorsal fin with a dark blotch.

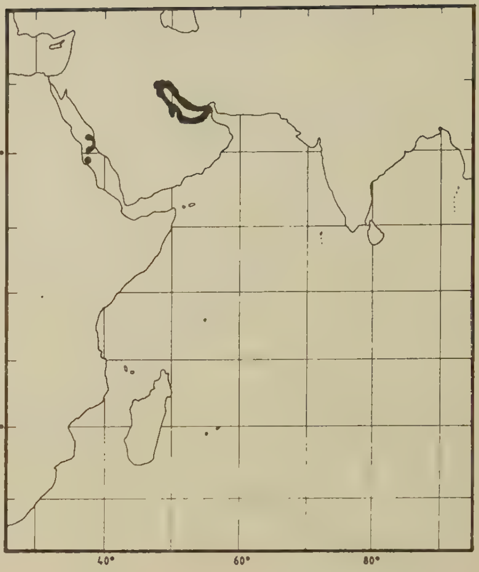
Geographical Distribution : The "Gulf"; possibly also Red Sea.

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 8 cm standard length, usually to 7 cm.

Interest to Fisheries : No separate statistics, but perhaps of potential interest.

Local Names : THE "GULF": Hashineh.



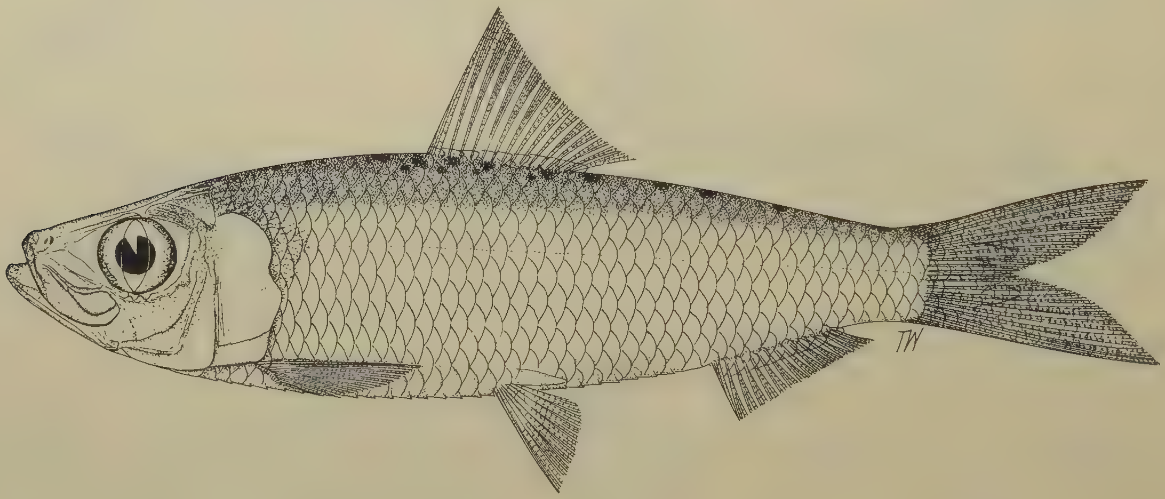
Herklotsichthys punctatus (Rüppell, 1837)

CLUP Herk 1

Clupea punctata Rüppell, 1837, Neue Wirbelth., Fische:78, pl. 21, fig. 2 (Red Sea).

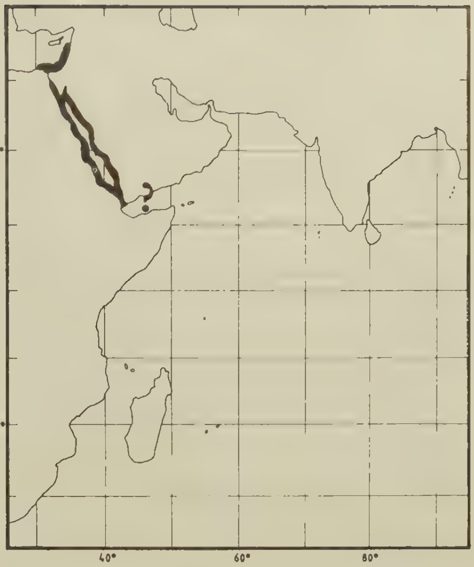
Synonyms : Harengula arabica Valenciennes, 1847:298 (Mohila, Red Sea, on Ehrenberg MS); Spratella erythraea Klunzinger, 1870:599 (Red Sea); Herklotsichthys punctatus - Whitehead, 1965:244 (Red Sea records only); Wongratana, 1988:149, pls 96, 97 (revision); FNAM, 1984:221 (Mediterranean). Note: the name punctata or punctatus has been widely misused in the literature for H. quadrimaculatus.

FAO Names : En - Spotback herring.



Diagnostic Features : Body slender, its depth 24 to 30% of standard length. Closely resembling H. lossei of the "Gulf" in shape, but the latter has a dark blotch on the dorsal fin and small dark spots along the flank and not on the black. Distinguished from H. spilurus by its more slender body (cf. depth 28 to 35% of standard length) and presence of spots on back. Overlaps range of H. quadrimaculatus, which lacks spots on the back and has elongate wing-like scales underneath the normal paired pre-dorsal scales. Flank silvery, without spots, but a series of very small dark spots on back on either side of dorsal fin base or behind it. See CLUP Herk 1, Fishing Area 51.

Geographical Distribution : Red Sea, possibly Gulf of Aden; immigrant into eastern Mediterranean (FNAM, 1984:221).



Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 8.5 cm standard length, usually to 7 cm.

Interest to Fisheries : No separate statistics.

Local Names : -

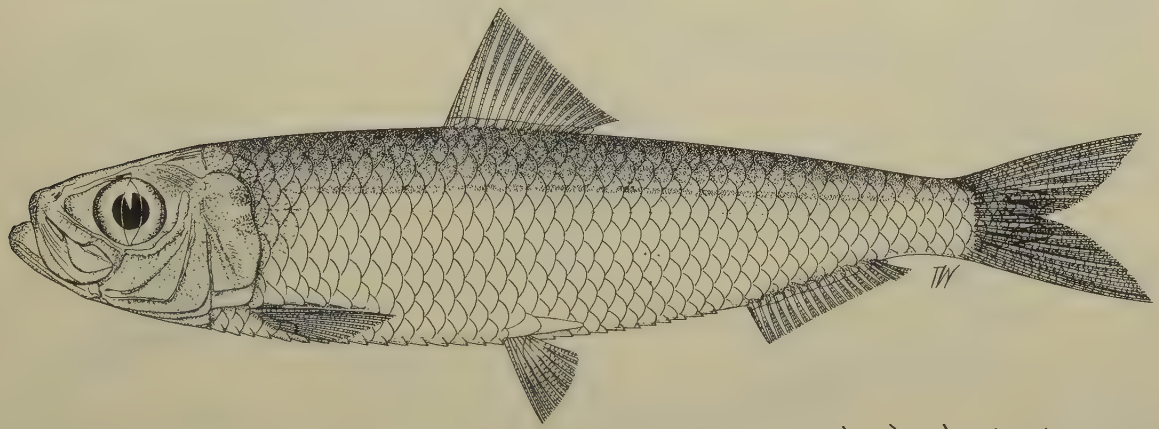
Herklotsichthys quadrimaculatus (Rüppell, 1837)

CLUP Herk 2

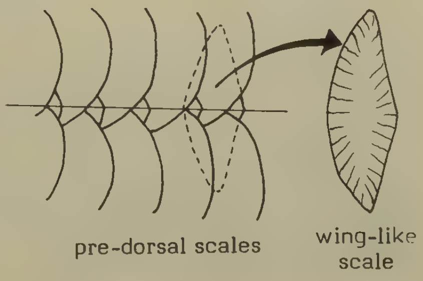
Clupea quadrimaculata Rüppell, 1837, *Neue Wirbelth., Fische*:78, pl. 21, fig. 3 (Bay of Massawa, Red Sea).

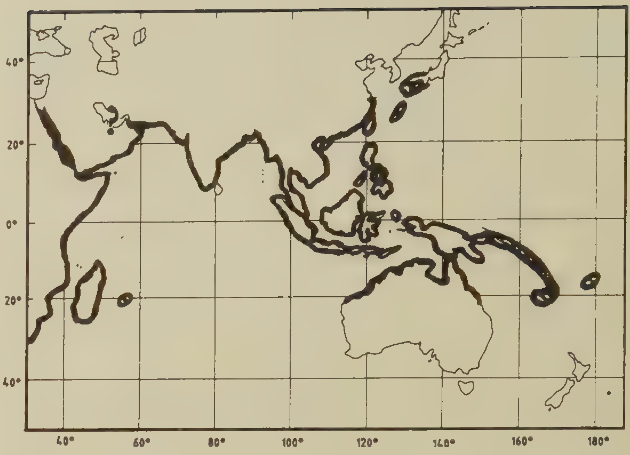
Synonyms : *Harengula bipunctata* Valenciennes, 1847:98 (on Ehrenberg MS; Massawa); *Sardinella lineolata* Valenciennes, 1847:272 (Trincomalee, Bourou Island); *Clupea fasciata* Valenciennes, 1847:349 (Saint-Denis de Bourbon); *Meletta obtusirostris* Valenciennes, 1847:375 (Seychelles); *Meletta venenosa* Valenciennes, 1847:377 (Seychelles); *Alausa schrammi* Bleeker, 1849:11 (Bali); *Harengula moluccensis* Bleeker, 1853:609 (Ternate, Amboina, Ceram); *Harengula kunzei* Bleeker, 1856:209 (Ternate); *Clupea (Harengula) dubia* Bleeker, 1872:108 (on *S. lineolata*); *Harengula stereolepis* Ogilby, 1897:759 (Torres St., Darnley Island, southeastern New Guinea); *Clupea mizun* Kishinouye, 1907:98, pl. 20, fig. 3 (Okinawa); *Clupea rechingeri* Steindachner, 1908:1424 (Samoa); *Harengula lippa* Whitley, 1931:142, fig. 1 (northwestern Australia); *Herklotsichthy punctatus* Form B:Losse, 1968:88 (East Africa). *Herklotsichthys quadrimaculatus* - Wongratana, 1980:139, pls 85, 86 (full synonymy, illustrations); SFSA, in press (southern Africa). Note: This species is widely given as *Harengula* or *Herklotsichthys punctatus* in the literature, although Fowler (1941:589) used the equally incorrect name *Harengula ovalis*.

FAO Names : En - Bluestripe herring.



Diagnostic Features : Body slender, its depth 18 to 30% or standard length. The presence of elongate wing-like scales underneath the normal paired pre-dorsal scales separates it from all other species except the two Australian species with prominent black spots on the flank (*H. koningsbergeri* and *Herklotsichthys* Species A) and the unspotted Australian *Herklotsichthys* Species B), which has dusky tips to dorsal and caudal fins and more lower gillrakers (36 to 42; cf. 33 to 36 in *H. quadrimaculatus*). Flank silvery with an electric blue line preceded by two orange spots. See CLUP Herk 2, Fishing Area 51.





Geographical Distribution : Widespread in Indian Ocean and western Pacific (entire eastern coast of Africa, Madagascar, Mauritius eastward to Japan, eastern Australia, Samoa). Introduced into Hawaii, apparently by accident, and now abundant (Williams & Clarke, 1983).

Habitat and Biology : Coastal, pelagic, schooling; daytime in a few metres of clear water, night-time into deeper water and further offshore (at least the adults). Feeds on zooplankton, mainly at night, chiefly copepods in juvenile stages, but larger prey as adults (chaetognaths, polychaetes, shrimps and small fishes); at no time is phyto-plankton taken (data from Williams & Clarke, 1983; Marichamy, 1970). Breeds during its first year and probably survives only a few months after maturity (Williams & Clarke, 1983: 595). Most previous data published under the name H. punctatus.

Size : To 14 cm standard length, usually about 10 cm.

Interest to Fisheries : Usually not separately reported, but probably combined with Sardinella catches. Locally of some importance in artisanal fisheries.

Local Names : USA: Gold spot herring (Hawaii).

Literature : Williams & Clarke (1983 - Hawaii, biology, but spawning not observed). Also Losse (1968 - as H. punctatus Form B, East Africa); Marichamy (1970, 1974 - as H. punctatus, in Indian waters, food, condition factor).

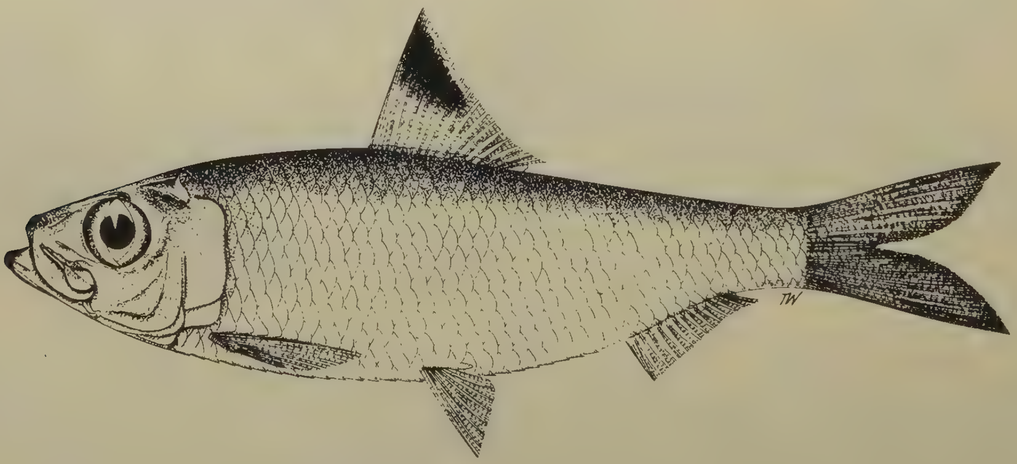
Herklotsichthys spilurus (Guichenot, 1863)

CLUP Herk 4

Harengula spilura Guichenot, 1863, In Maillard, Ile de Réunion poiss.:16 (Bourbon).

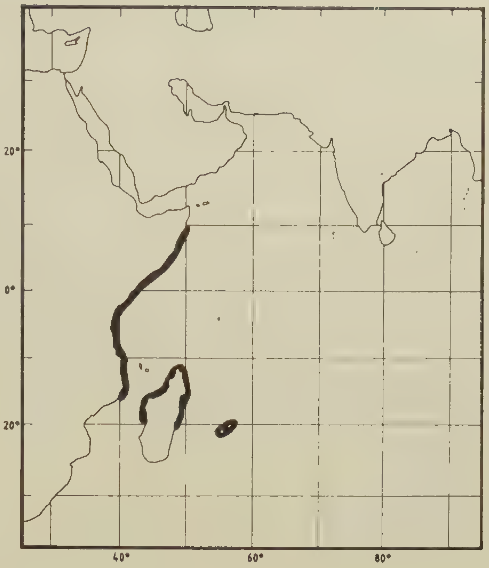
Synonyms : Herklotsichthys punctatus Form A:Losse, 1968:88 (Kenya, Zanzibar); Whitehead, 1973b:176 (on Losse); Herklotsichthys spilurus:Wongratana, 1981:149, pls 94, 95; Whitehead & Bauchot, in press (type of spilura).

FAO Names : En - Reunion herring.



Diagnostic Features : Body moderately deep, its depth usually 28 to 35% of standard length. Resembles H. lossei, which is more slender (depth 26 to 28% of standard length) and has small dark spots on the flank. Overlaps range of H. quadrimaculatus, which has elongate wing-like scales underneath the normal paired predorsal scales. Flank silvery, without dark spots; a bright yellow or orange patch behind gill opening; dark blotch on tip of dorsal fin.

Geographical Distribution : Zanzibar, Kenya coast, Réunion Island, presumably also Madagascar.



Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 8.5 cm standard length, usually to 7 cm.

Interest to Fisheries : No separate statistics, but probably enters artisanal fisheries.

Local Names : ZANZIBAR: Dagaa (but used for other similar clupeids).

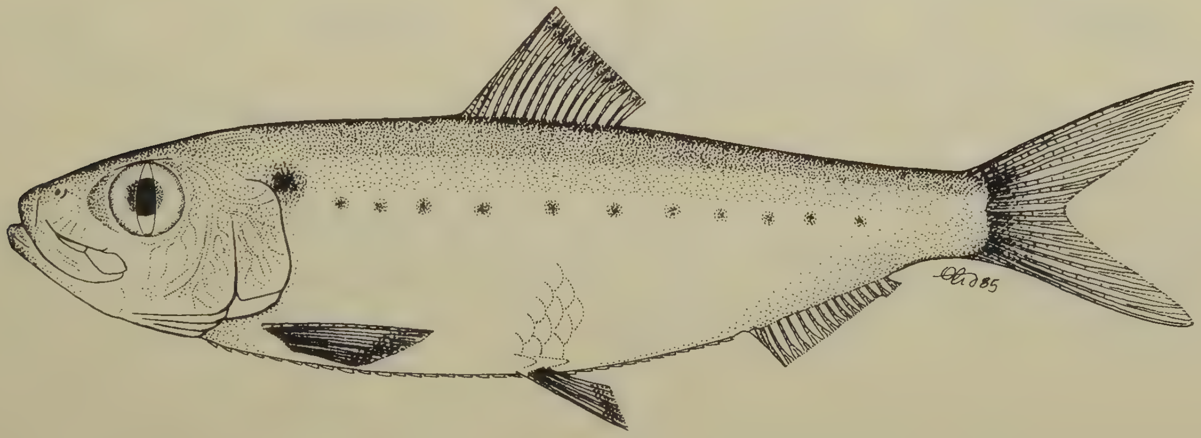
Herklotsichthys Species A

CLUP Herk 10

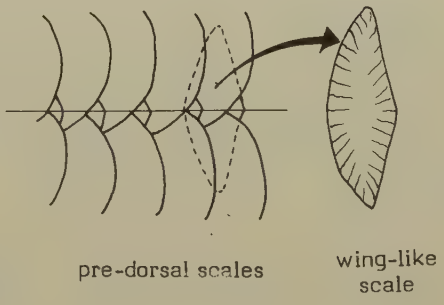
(AWAITING DESCRIPTION AND NAME)

Synonyms : Harengula koningsbergeri:Munro, 1956:23, fig. 161 (not H. koningsbergeri of Weber & deBeaufort, which Munro in error called H. maccullochi Whitley); ? Harengula ovalis:Munro, 1956:23, fig. 160 (sensu Fowler, 1941:589, i.e. H. quadrimaculatus).

FAO Names : En - Australian spotted herring.



Diagnostic Features : Body moderately slender, its depth 29 to 35% of standard length. Distinguished from all other Australian Herklotsichthys by the series of small round black spots on the flank (H. koningsbergeri has much larger oval spots and is deeper-bodied, its depth 37 to 40% of standard length; also, hind edges of its scales denticulated and lower gillrakers 28 to 31; cf. 33 to 36 in Species A). Elongate wing-like scales underneath normal paired pre-dorsal scales. A dark spot behind gill cover.



Geographical Distribution : Western Australia (Exmouth Gulf to Gulf of Carpenteria, Cape York and Aru Islands).

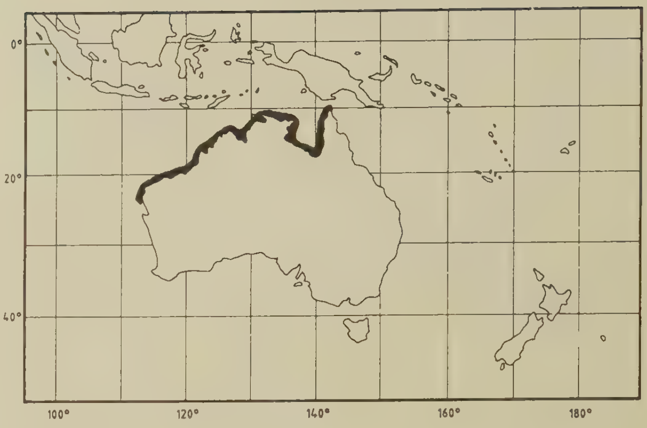
Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 16 cm standard length, usually to 14 cm.

Interest to Fisheries : No separate statistics; possibly more abundant than *H. koningsbergeri*.

Local Names : -

Literature : Munro (1956 - as *H. koningsbergeri*, description, brief notes).



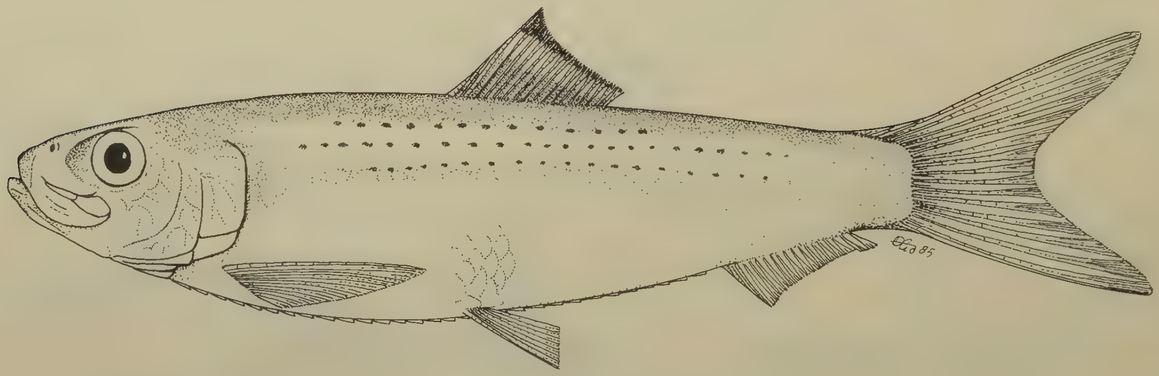
Herklotsichthys Species B

CLUP Herk 11

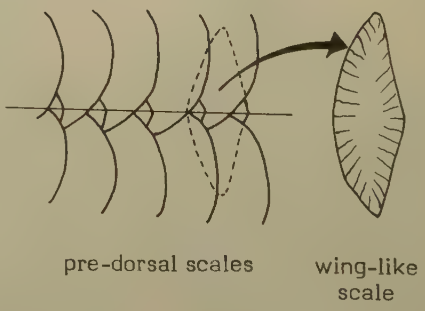
(AWAITING DESCRIPTION AND NAME)

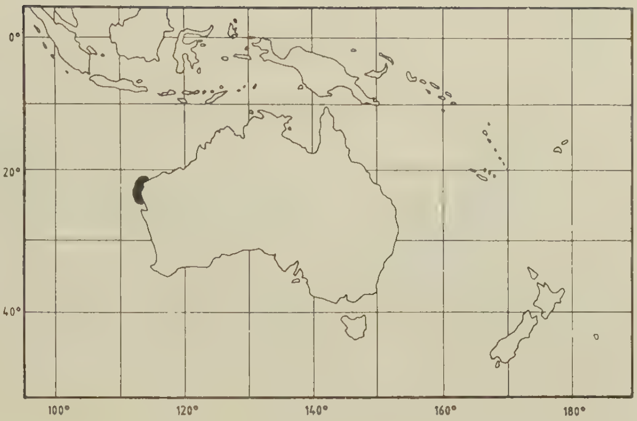
Synonyms : ? *Harengula lippa* of authors, e.g. Munro, 1956:23, fig. 159 (not *H. lippa* Whitley, which is *H. quadrimaculatus*).

FAO Names : En -



Diagnostic Features : Body slender, its depth 27 to 35% of standard length. Distinguished from most other Australian *Herklotsichthys* by the presence of elongate wing-like scales beneath the normal paired pre-dorsal scales and absence of spots along the flank. Closely resembles *H. quadrimaculatus* in these features, but has more lower gillrakers (36 to 42; cf. 32 to 35 in *H. quadrimaculatus*). Three fine dark lines along upper flank and dorsal fin with distinct pale band separating grey base from black tip.





Geographical Distribution : Western Australia (Shark Bay to Onslow).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 13 cm standard length, usually to 10 cm.

Interest to Fisheries : No separate statistics.

Local Names : AUSTRALIA: Oily herring (Munro, 1956 - if it was indeed this species).

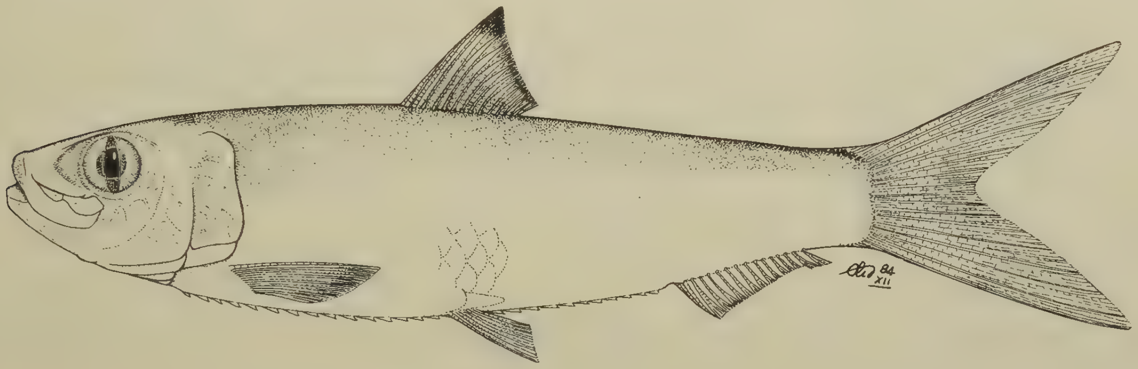
Herklotsichthys Species C

CLUP Herk 12

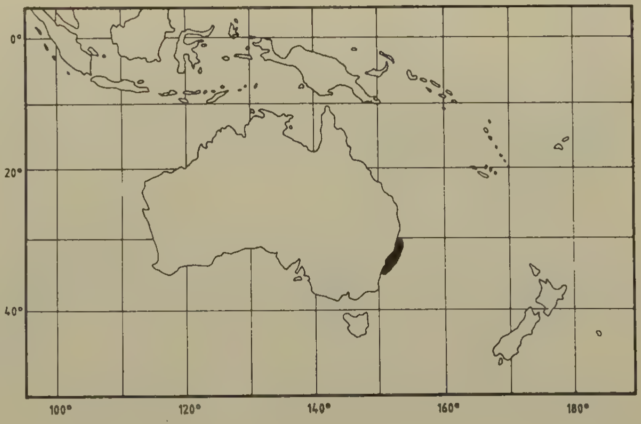
(AWAITING DESCRIPTION AND NAME)

Synonyms : None.

FAO Names : En



Diagnostic Features : Body moderately slender, its depth about 30% of standard length. Distinguished from most other Australian Herklotsichthys by lacking spots on the flank (H. koningsbergeri, Herklotsichthys Species A) and lacking elongate wing-like scales beneath the normal paired pre-dorsal scales (the previous two species, also H. quadrimaculatus and Herklotsichthys Species B). Resembles H. blackburni and especially H. castelnaui (same range), but lacks the three distinct dark lines along upper flank. Distinguished from H. gotoi by having more lower gillrakers (47 to 48; cf. 34 to 38) and no dark spot behind gill cover; also dorsal fin with distinct pale band separating grey base from black tip and a dark line along upper edge of caudal peduncle.



Geographical Distribution : Eastern Australia (Warrell Creek at Scott's Head, New South Wales).

Habitat and Biology : More data needed.

Size : To 9 cm standard length.

Interest to Fisheries : Probably nil.

Local Names : -

Literature : -

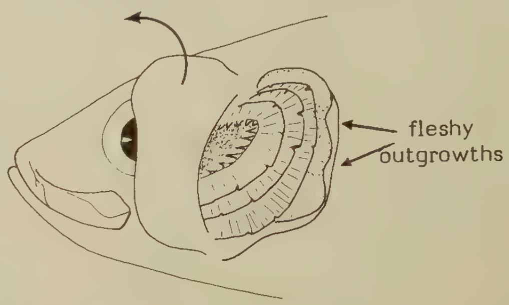
Remarks : Very similar to H. castelnaui in number of lower gillrakers and colour pattern, except lacking the lines along upper flank. More specimens may show it to be that species.

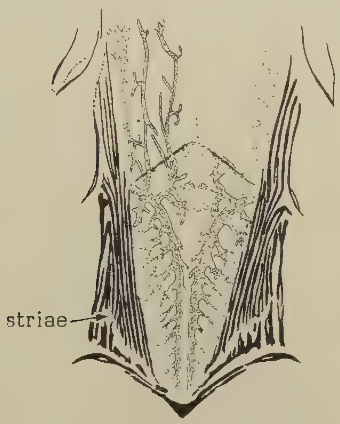
Amblygaster Bleeker, 1849

CLUP Ambl

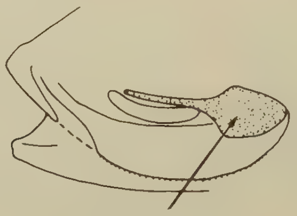
Amblygaster Bleeker, 1849, J.Ind.Arch., 3:73 (type, Amblygaster clupeoides Bleeker). Fusiclupea Whitley, 1940, Aust.Zool., 9(4):401 (type: Sardinops (Fusiclupea) dakini Whitley = A. sirm). Sardinella: widely used until recently for the 3 species of Amblygaster, also many authors acknowledged Amblygaster as a subgenus.

Diagnostic Features : The presence of two fleshy outgrowths on the hind margin of the gill opening distinguishes Amblygaster from all other clupeid genera except Harengula and Opisthonema (both restricted to New World; also characterized by a toothed hypo-maxilla and a filamentous last dorsal finray respectively) and Herklotsichthys and Sardinella. Amblygaster has 7 to 14 fronto-parietal striae on top of the head, a symmetrical second supra-maxilla and the last two anal finrays enlarged (3 to 7 striae, an asymmetrical second supra-maxilla and final anal finrays normal in Herklotsichthys). Amblygaster most closely resembles Sardinella and was formerly combined with it, but has only 26 to 43 lower gillrakers and a median series of pre-dorsal scales (cf. 40 to 100 lower gillrakers, or up to 200 or more in some species, and a median series of pre-dorsal scales (usually paired pre-dorsal scales in Sardinella). In general body shape species of Amblygaster resemble Sardinops (but bony striae on operculum).

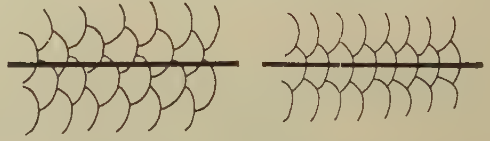




fronto-parietal striae
on top of head



2nd supra-maxilla
symmetrical



a. Sardinella b. Amblygaster

pre-dorsal scales

Biology, Habitat and Distribution : Marine, pelagic and schooling. Indo-Pacific region only, mainly in tropical or subtropical waters.

Interest to Fisheries : Contributes to numerous local artisanal fisheries, but usually not separated in statistics from general clupeoid catches.

Species : The most recent revision, by Wongratana (1980), recognized 3 species:

A. clupeoides Bleeker, 1849, Indo-West Pacific
A. leiogaster (Valenciennes, 1847), Indo-West Pacific
A. sirm (Walbaum, 1792), Indo-West Pacific.

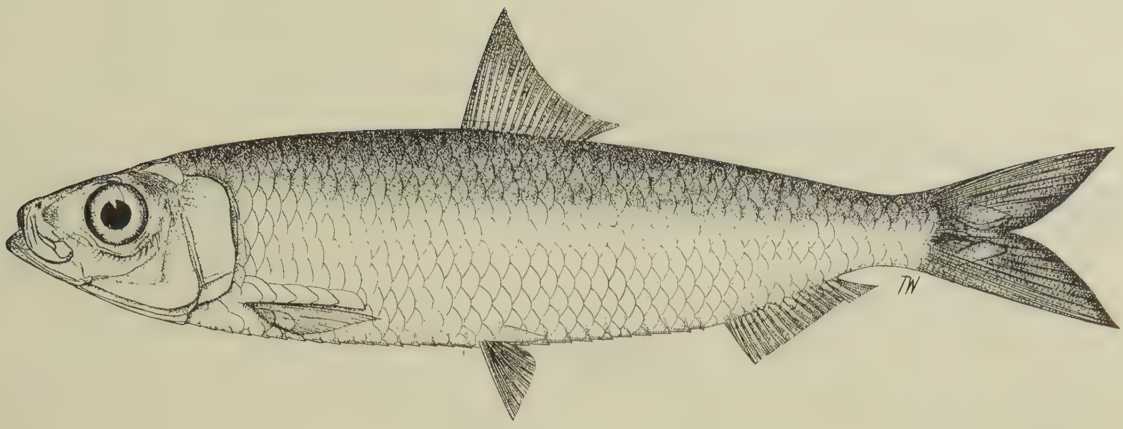
Amblygaster clupeoides Bleeker, 1849

CLUP Ambl 1

Amblygaster clupeoides Bleeker, 1849, J.Ind.Arch., 3:73 (Macassar).

Synonyms : Sardinella clupeoides:Fowler, 1941:619; Bennet, 1965:1 (India); Chan, 1965:115, fig. 14 (description, synonyms); Whitehead et al., 1966:67 (type); Whitehead, 1973b:188 (Indian Ocean); Nair, 1973:62 (India); Amblygaster clupeoides - Wongratana, 1980:137, pls 81, 82 (revision).

FAO Names : En - Bleeker's smoothbelly sardinella.



Diagnostic Features: Body moderately slender, belly rather rounded, scutes not prominent. Distinguished from A. sirm by the absence of spots along the flank (gold in life, black on preservation) and fewer lower gillrakers (26 to 31; cf. 33 to 43 in A. sirm). Closely resembles A. leiogaster, which has more lower gillrakers (31 to 33). Round-bodied Sardinella species (S. longiceps, etc.) have i 8 pelvic finrays (i 7 in A. clupeoides) and more than 100 lower gillrakers. See CLUP Ambl 1, Fishing Area 51.

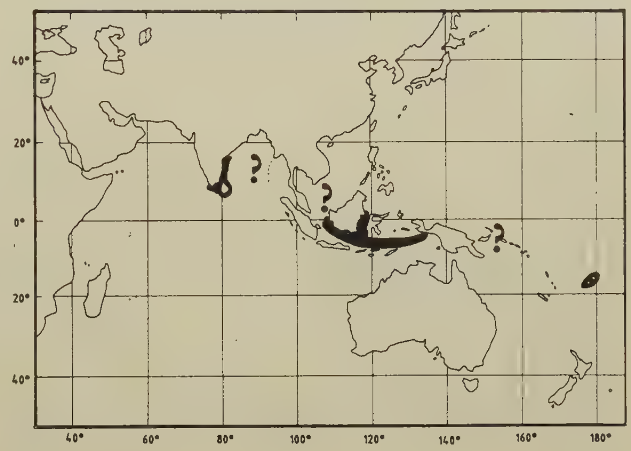
Geographical Distribution: Eastern Indian Ocean (southern coasts of India, perhaps Bay of Bengal) and Indonesia eastward to Fiji.

Habitat and Biology: Coastal, pelagic, schooling. Feeds on copepods, Mysis and other elements in the zooplankton (Bennet, 1965).

Size: To 17 cm standard length, usually to 15 cm.

Interest to Fisheries: No separate statistics, but evidently enters some local artisanal fisheries, at least in small numbers.

Local Names: -



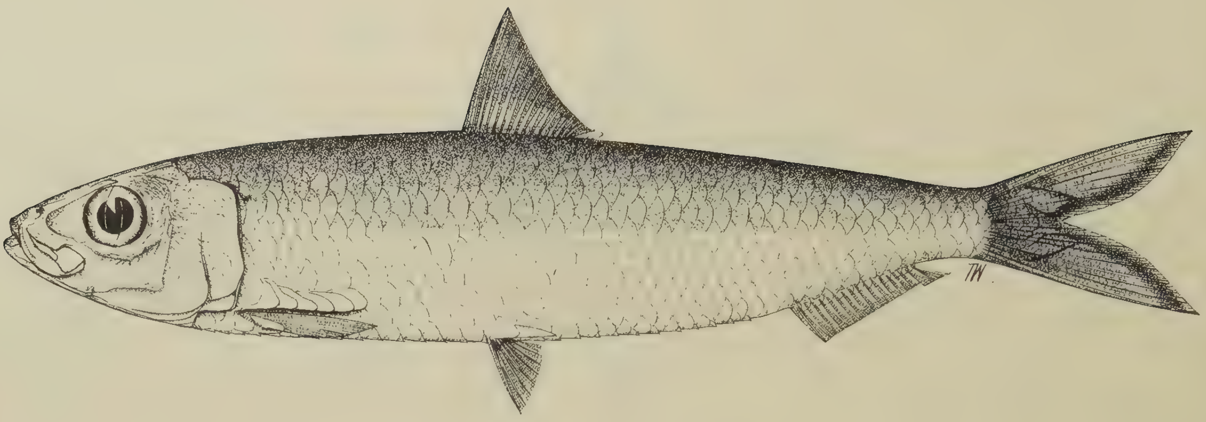
Amblygaster leiogaster (Valenciennes, 1847)

CLUP Ambl 2

Sardinella leiogaster Valenciennes, 1847, Hist.nat.poiss., **20**:270 (Indian Ocean, Trincomalee).

Synonyms: Clupea okinawensis Kishinouye, 1907:96, pl. 19, fig. 2, pl. 21, fig. 5 (Okinawa); Sardinella leiogaster: Chan, 1965:117, fig. 15 (description); Whitehead, 1967a:68 (type); Idem, 1973b:188, fig. 18 (Indian Ocean); Losse, 1968:101 (East Africa); Menon & Talwar, 1974:41 (India); Wongratana, 1980:138, pls 83, 84 (revision).

FAO Names: En - Smoothbelly sardinella.



Diagnostic Features : Body moderately slender, belly rather rounded, scutes not prominent. Distinguished from *A. sirm* by the absence of spots along the flank (gold in life, black on preservation) and fewer lower gillrakers (31 to 35; cf. 33 to 43 in *A. sirm*). Closely resembles *A. clupeoides*, which has fewer lower gillrakers (26 to 31). Round-bodied *Sardinella* species (*S. longiceps*, etc.) have i 8 pelvic finrays (i 7 in *A. leiogaster*) and more than 100 lower gillrakers. See CLUP Ambl 2, Fishing Area 51 (also CLUP Sardl 10, Fishing Areas 57, 71).

Geographical Distribution : Indo-West Pacific (coasts of Africa eastward to Okinawa, also Western Australia).

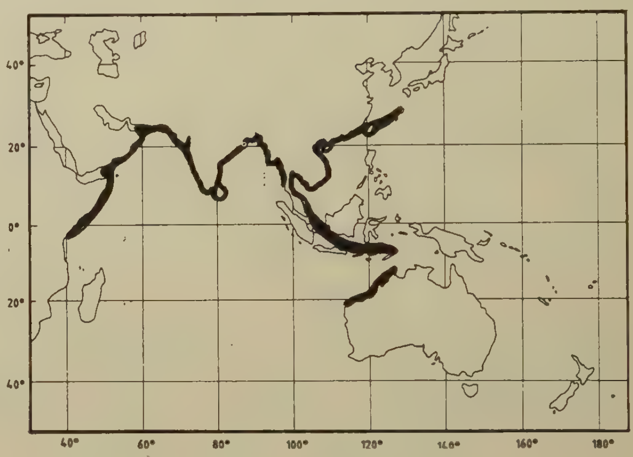
Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 23 cm standard length, usually to 18 cm.

Interest to Fisheries : No separate statistics, but evidently enters some local artisanal fisheries, at least in small numbers.

Local Names : JAPAN: Yamato-mizun (Okinawa).

Literature : Losse (1968 - East Africa).



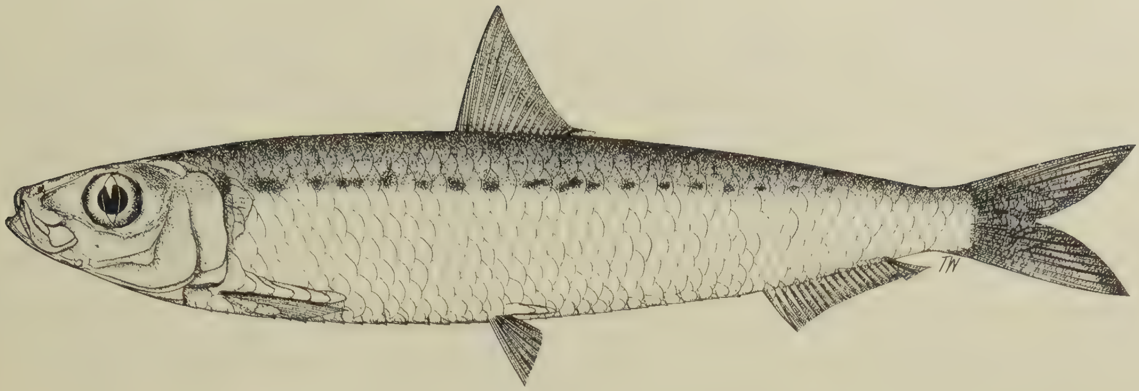
Amblygaster sirm (Walbaum, 1792

CLUP Ambl 3

Clupea sirm Walbaum, 1792, *in* Artedi, *Gen.pisc.*:38 (on Forsskål, 1775, *Descript.anim.*:17 - Arabia).

Synonyms : *Sardinella leiogastroides* Bleeker, 1854:255 (Manado, Sulawesi); *Clupea pinguis* Günther, 1872:425 (Misol); *Sardinops dakini* Whitley, 1937:114; *Sardinella sirm*:Fowler, 1941:616; Chan, 1965:113, fig. 13 (description, synonyms); Whitehead *et al.*, 1966:69 (type of *leiogastroides*); Losse, 1968:99 (East Africa; Raja & Hiyama, 1969:105 (Okinawa); Whitehead, 1973b:187, fig. 17 (Indian Ocean); Nair, 1973:58 (India); *Amblygaster sirm* - Wongratana, 1980:135, pls 79, 80 (revision).

FAO Names : En - Spotted sardinella.

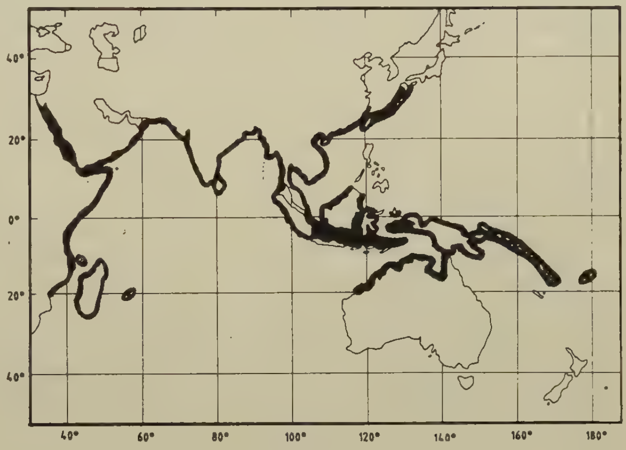


Diagnostic Features : Body slender, belly rather rounded, scutes not prominent. Distinguished from *A. clupeoides* and *A. leiogaster* by the presence of a series of 10 to 20 gold (in life) or black (on preservation) spots down the flank (but sometimes missing); also, lower gillrakers 33 to 43 (26 to 33 in the other two species). *Sardinops* species are also round-bodied and have spots on the flanks, but possess bony radiating striae on the gill cover. Round-bodied *Sardinella* species (*S. longiceps*, etc.) have i 8 pelvic finrays (i 7 in *A. sirm*) and more than 100 lower gillrakers, also no spots. See CLUP Ambl 3, Fishing Area 51 (also CLUP Sardl 9, Fishing Areas 57, 71).

Geographical Distribution : Indo-West Pacific (coasts of Africa, including Red Sea and Madagascar, eastward to the Philippines, Taiwan Island, Okinawa, New Guinea, Fiji and northern coasts of Australia).

Habitat and Biology : Coastal, pelagic, schooling. Feeds mainly on copepods, nauplii and zoea larvae, larval bivalves and gastropods, *Peridinium* and *Ceratium* (Chacko, 1956); juveniles also on phytoplankton (Basheeruddin & Nayar, 1962). Breeds November-December, February-March, May-June and August-September in Indian waters (Nair, 1973:59). Mature at 14 to 15 cm standard length (Gnanamekalai, 1962).

Size : To 23 cm standard length, usually to about 20 cm.



Interest to Fisheries : No separate statistics, but enters some local artisanal fisheries, e.g. in Tuticorin Bay in November-March (Chacko, 1956), and in Fiji (Lewis, Smith & Ellway, 1983).

Local Names : INDIA (Tamil): Keerimeen chalai.

Literature : Nair (1973 - good summary for Indian Ocean, biology, fisheries); Losse (1968 - East Africa).

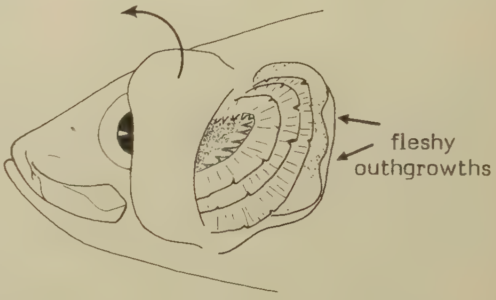
Remarks : The number of spots on the flanks shows some variation (10 to 20), but this has not yet been correlated with locality, sex or other factors. Raja & Hiyama (1969:106) noted "more than 30 dark spots" which were above the interface between silver flank and dark back (normally they lie along this interface); they also noted that the spots were faint or absent in some specimens.

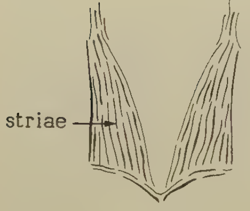
Sardinella Valenciennes, 1847

CLUP Sardl

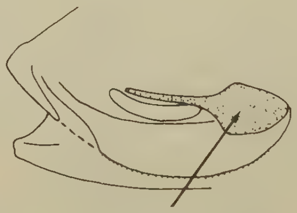
Sardinella Valenciennes, 1847, Hist.nat.poiss., **20**:18 (type: Sardinella aurita Valenciennes). Clupeonia Valenciennes, 1847, Hist.nat.poiss., **20**:345 (type: Clupeonia jussieui Valenciennes). Kowala Valenciennes, 1847, Hist.nat.poiss., **20**:362 (type: Kowala albella Valenciennes). Clupalosa Bleeker, 1849, Verh.batav.Genoot.Kunst. Wet., **22**:12 (type: Clupalosa bulan Bleeker = Kowala albella Valenciennes). Sardinia Poey, 1860, Mem.Hist.nat. Cuba, **2**:311 (type: Sardinia pseudohispanica Poey = Sardinella aurita Valenciennes). Paralosa Bleeker, 1868, Verst.Meded.K.Akad.wet.Amst., **2**(2):300 (type: Harengula (Paralosa) valenciennesi Bleeker = Clupea melanura Cuvier). Wilkesina Fowler & Bean, 1923, Proc.U.S.natn.Mus., **63**:3 (type: Harengula fijiense Fowler & Bean). Fimbriclupea Whitley, 1940, Aust.Zool., **9**(4):399 (type: Fimbriclupea dactylolepis Whitehead = Clupea gibbosa Bleeker). Fiscina Whitley, 1940, Aust.Zool., **9**(4):400 (type: Fiscina posterus Whitley = Sardinella lemuru Bleeker).

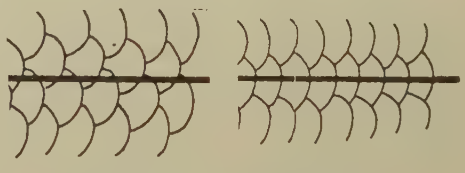
Diagnostic Features : The presence of two fleshy outgrowths on the hind margin of the gill opening distinguishes Sardinella from all other clupeoid genera except Harengula (New World; a toothed hypo-maxilla present), Opisthonema (New World; last dorsal finray filamentous), Herklotsichthys (Indo-West Pacific; only 3 to 7 fronto-parietal striae on top of head, second supra-maxilla asymmetrical, final two anal finrays not enlarged) and Amblygaster. Sardinella closely resembles Amblygaster (the two were formerly combined) in having 7 to 14 fronto-parietal striae, a symmetrical paddle-shaped second supra-maxilla and the last two anal finrays distinctly enlarged, but has more, often many more, lower gillrakers (40 to 100, or up to 200 or more in round-bodied species; cf. 26 to 43 in Amblygaster); also, all round-bodied species of Sardinella have paired predorsal scales (a single median series in Amblygaster). Superficially, the round-bodied Sardinella resemble Clupea and Strangomera, whose ranges they sometimes overlap in the North Atlantic and perhaps also in the North and South Pacific, but the characters listed above distinguish them (gill opening, fronto-parietal striae, enlarged anal finrays).





fronto-parietal striae
on top of head


2nd supra-maxilla
symmetrical



pre-dorsal scales

Biology, Habitat and Distribution : Marine, pelagic and schooling; some species enter lagoons and estuaries, usually as juveniles. Species of the subgenus Sardinella occur on both sides of the Atlantic, in the Mediterranean and throughout the tropical and subtropical parts of the Indo-West Pacific; members of the subgenus Clupeonia are found mainly in the Indo-West Pacific, but 2 species are in the eastern Atlantic (of which one extends into the Mediterranean).

Interest to Fisheries : A number of species make a very significant contribution to artisanal and fully mechanized fisheries, while numerous others are collectively important in the Indo-West Pacific region (of much more importance than are species of Herklotsichthys, as can be seen in the fish markets of India and southeast Asia). The total recorded catch for Sardinella in 1983 was 1 499 437 tons (about 60% unidentified; the major species were S. longiceps and S. aurita.

Species : In the last revision of Indo-West Pacific species, Wongratana (1980) recognized 18 species and subsequently described one of these as new and gave a replacement name to another (Wongratana, 1983). To these can be added 4 further species from the Atlantic and Mediterranean. Identification of some species, especially the smaller members of the subgenus Clupeonia, is often extremely difficult and in the case of juveniles sometimes impossible. As an aid to identification, the geographical distribution of the species should serve as a first step once the correct subgenus has been determined:

Subgenus *Sardinella* (pelvic finrays i 8; mostly rather round-bodied species)

S. aurita Valenciennes, 1847, Atlantic (both sides and Mediterranean), also Japan
S. brasiliensis (Steindachner, 1879), western Atlantic (? also eastern Atlantic and Mediterranean)
S. lemuru Bleeker, 1853, Indonesia, Western and northern Australia, North China Sea
S. longiceps Valenciennes, 1847, Indian Ocean (northern part)
S. neglecta Wongratana, 1983, Indian Ocean (East African coast)

Subgenus *Clupeonia* (pelvic finrays i 7; mostly more compressed species)

Widespread
S. albella (Valenciennes, 1847)
S. brachysoma (Bleeker, 1852)
S. fimbriata (Valenciennes, 1847)
S. gibbosa (Bleeker, 1849)
S. melanura (Cuvier, 1829)

Western Indian Ocean
S. jussieui (Valenciennes, 1847) (southern India, Madagascar, Mauritius)
S. sindensis (Day, 1878) (northern part only)

Western Pacific, northern part
S. hualiensis (Chu & Tsai, 1958) (Taiwan Island)
S. richardsoni Wongratana, 1983 (South China Sea)
S. tawilis (Herre, 1927) (South China Sea)
S. zunasi (Bleeker, 1854) (China, Japan)

Western Pacific, southern part
S. atricauda (Günther, 1868) (Indonesia)
S. fijiense (Fowler & Bean, 1923) (New Guinea, Fiji)
S. marquesensis Berry & Whitehead, 1968 (Marquesas Islands)

Eastern Atlantic
S. maderensis (Lowe, 1839), eastern Atlantic, Mediterranean
S. rouxi (Poll, 1953), eastern Atlantic (western Africa).

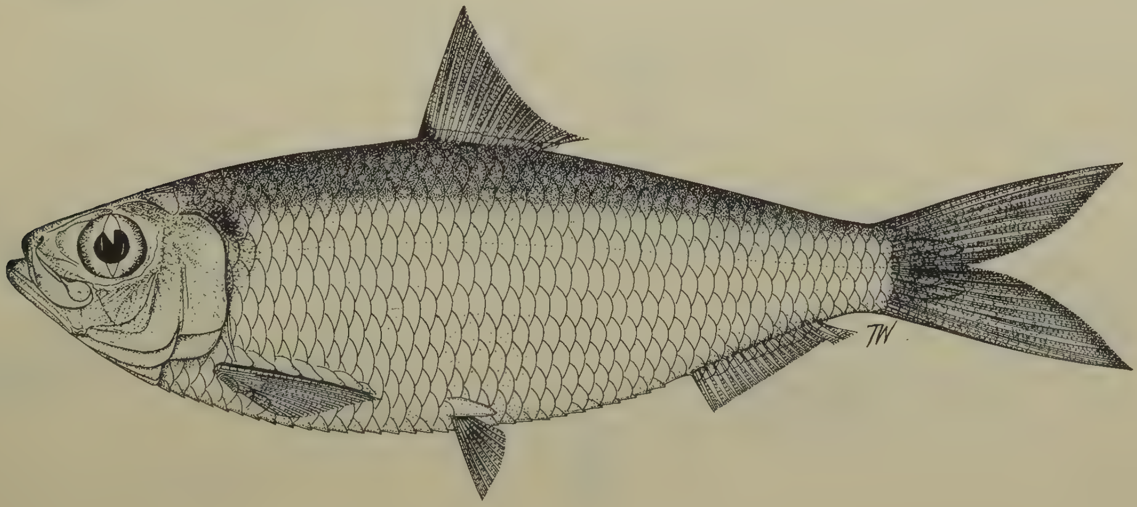
Sardinella albella (Valenciennes, 1847)

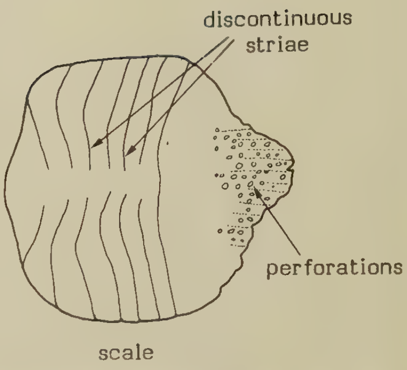
CLUP Sardl 6

Kowala albella Valenciennes, 1847, *Hist.nat.poiss.*, **20**:362 (Pondicherry).

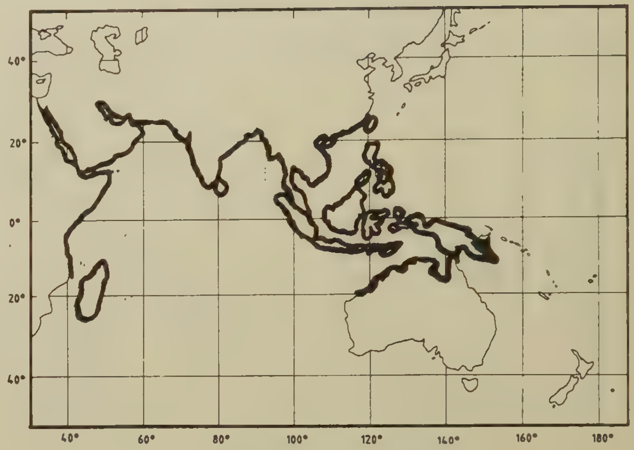
Synonyms : *Clupalosa bulan* Bleeker, 1849:12 (Indonesia); *Kowala lauta* Cantor, 1850:297 (Penang); *Clupea perforata* Cantor, 1850:1276 (Penang to Sumatra and Singapore); *Spratella kowala* Bleeker, 1851:492 (Rio, Batavia); *Clupea (Harengula) sundaica* Bleeker, 1872:105 (Batavia, etc.); *Harengula dollfusi* Chabanaud, 1933:1, figs 1-2 (Gulf of Suez); *Sardinella perforata*:Fowler, 1941:605 (the Philippines); Chan, 1965:16, fig 7B (Thailand to Taiwan Island); *Sardinella bulan*:Whitehead, 1963:33-41 (types of *bulan*, *perforata*, *kowala*); Whitehead *et al.*, 1966:53, 55, 61 (types of *bulan*, *kowala*, *sundaica*); *Sardinella albella*:Losse, 1968:96 (East Africa); Whitehead, 1973b:183, fig. 13; Wongratana, 1980:121, pls 58, 59 (revision); SFSA, in press (southern Africa); Whitehead & Bauchot, in press (types of *albella*, *dollfusi*).

FAO Names : En - White sardinella.





Diagnostic Features: Body somewhat compressed but variable, from slender to moderately deep, its depth 25 to 40% of standard length; total number of scutes 29 to 33 (usually 30 to 32). Lower gillrakers 41 to 68 (at 4 to 15 cm standard length, increasing a little with size of fish). Vertical striae on scales not meeting at centre, hind part of scale with a few perforations and somewhat produced posteriorly. A dark spot at dorsal fin origin. Closely resembles S. fimbriata and S. dayi, which have more lower gillrakers (54 to 82, usually more than 55 in S. fimbriata; 88 to 126 in S. dayi) and can be confused with S. gibbosa and S. sindensis, which have more scutes (31 to 34, usually 32 or 33). Other similar species have more scutes or more gillrakers or overlapping scale striae or no spot at dorsal fin origin or caudal tips black (or a combination of some of these features). See CLUP Sardl 6, Fishing Area 51, also Areas 57, 71.



Geographical Distribution: Indo-West Pacific (Red Sea, the "Gulf", East African coasts, Madagascar eastward to Indonesia, north to Taiwan Island, south to Papua New Guinea).

Habitat and Biology: Coastal, pelagic, schooling. Misidentifications make published biological data potentially unreliable. The biology is summarized by Nair (1960, 1973).

Size: To 14 cm standard length, usually to 10 cm.

Interest to Fisheries: Included in the general statistics for Sardinella, but of some importance along the western coasts of India (although fishery statistics probably include S. fimbriata and S. gibbosa).

Local Names: Mostly the same as for S. gibbosa.

Literature: Nair (1960, 1973 - India, synopsis of biology and fisheries); Losse (1968 - East Africa).

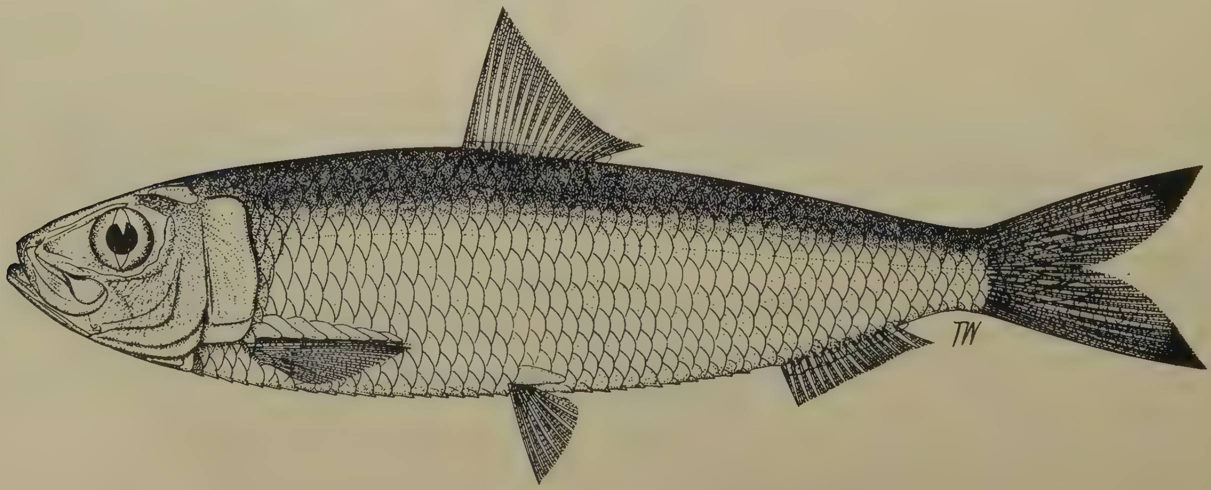
Sardinella atricauda (Günther, 1868)

CLUP Sardl 16

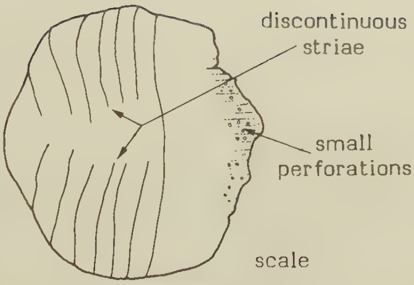
Clupea atricauda Günther, 1868 (14 March), Cat.Fishes Brit.Mus., 7:426 (Ceram; Bleeker's specimen of Harengula melanurus).

Synonyms: Harengula melanurus Bleeker, 1853:245 (not Clupea melanurus Cuvier, 1829); Harengula (Paralosa) valenciennesi Bleeker, 1868 (presumed after 14 March): 300 (Waigou; replacement name for his Harengula melanurus); Wongratana, 1980:134, pls 77, 78 (revision). Note: included by Fowler (1941:615), Chan (1965:5); Whitehead et al. (1966:63); Whitehead (1973b:180) and others in the synonymy of S. melanura.

FAO Names: En - Bleeker's blacktip sardinella.



Diagnostic Features : Body slender, its depth 23 to 27% of standard length; total scutes 32 to 35 (pre-pelvic scutes usually 19). Lower gillrakers 39 to 43, with many asperities on them (probably not increasing in number in larger fishes). Vertical striae on scales not meeting at centre, numerous small perforations on hind part of scale. No dark spot at dorsal fin origin; tips of caudal fin black. Most closely resembles S. melanura, which also has black caudal fin tips, but fewer scutes (27 to 31). Other Sardinella species lack the black caudal tips or have more gillrakers or fewer scutes or occur outside the area.



Geographical Distribution : Western Pacific (Java Sea from Jakarta to Amboina, but perhaps more widespread in Indonesia).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

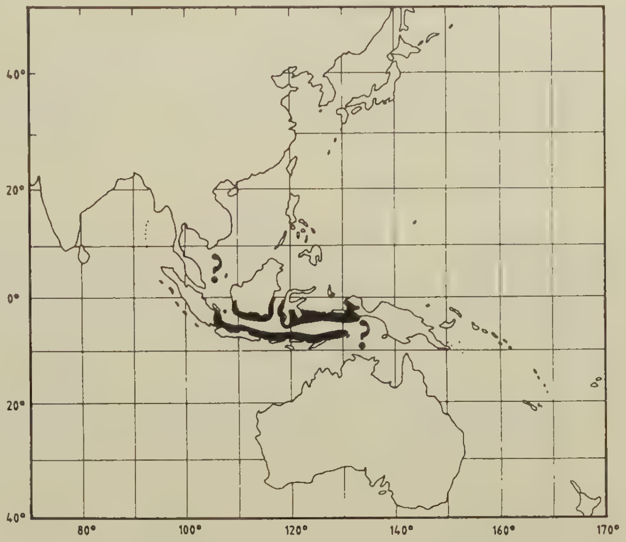
Size : To 12.6 cm standard length, usually to about 10 cm.

Interest to Fisheries : Presumably contributes to local Sardinella catches.

Local Names : -

Literature : See under synonyms.

Remarks : Occurs with S. melanura in the Java Sea and must have been confused with it frequently.



Sardinella aurita Valenciennes, 1847

CLUP Sardl 1

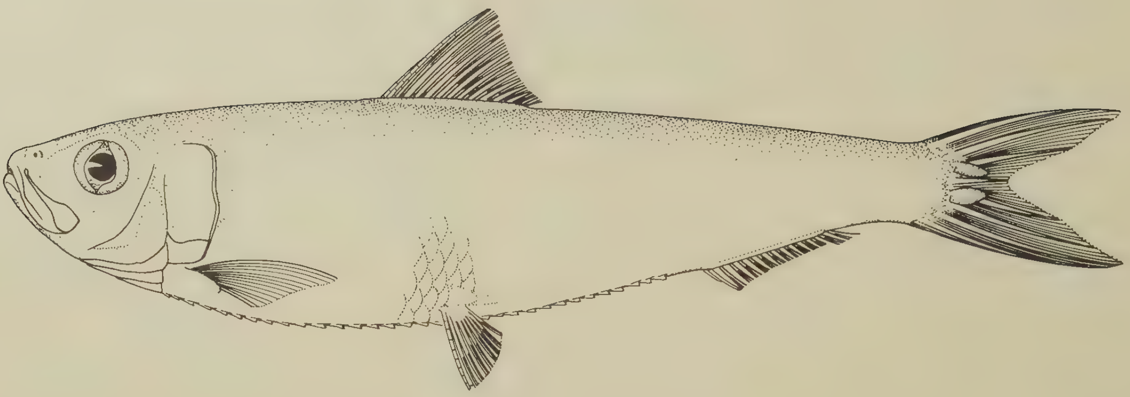
Sardinella aurita Valenciennes, 1847, Hist.nat.poiss., **20**:263 (Messina to Gulf of Morée, Greece).

Synonyms : These are separated for the two major areas of distribution:

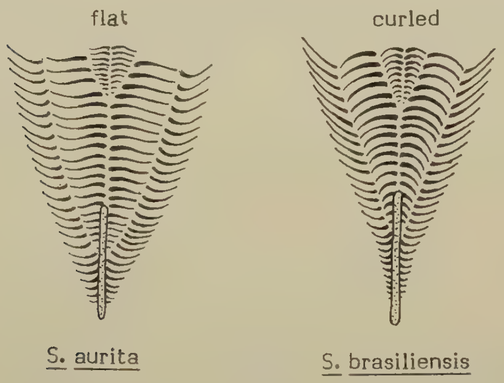
(a) **Eastern Atlantic :** Clupea allecia Rafinesque, 1810:57 (Sicily; potential nomen oblitum, but not yet formally suppressed as such); Alosa senegalensis Bennett, 1831 (Senegal; overlooked and should be designated a nomen oblitum); Clupea aurovittata Swainson, 1838 (nomen nudum) and 1839:385 (Palermo; overlooked, another potential nomen oblitum); Meletta mediterranea Valenciennes, 1847: 369 (Toulon, Marseille); Sardinella cuxina Antipa, 1906:46, pl. 3, figs 12 to 18 (Black Sea); Clupea venulosa Steinitz, 1927:323 (Haifa); Sardinella aurita terrasae Lozano y Rey, 1950:14, pl. 3, fig. 2 (Western Sahara, Canaries); Sardinella aurita var. mediterranea:Rossignol, 1959:215 (Mediterranean). Sardinella aurita - Svetovidov, 1952:172, pl. 5, fig. 2 (Russian waters); Idem, 1963:189, pl. 5, fig. 2 (same); CLOFNAM, 1973:103 (full synonymy for Mediterranean and eastern Atlantic); FNAM, 1984:222 fig. ; CLOFETA, in press (eastern central Atlantic, full synonymy); SFSA, in press (southern Africa); Whitehead & Bauchot, in press (types of aurita, mediterranea).

(b) **Western Atlantic :** Sardinella anchovia Valenciennes, 1847:269 (Rio de Janeiro); FWNA, 1963:401, fig. 99 (synopsis of taxonomy and biology); Cervigón, 1966:120, fig. 50 (Venezuela); Sardinia pseudohispanica Poey, 1860:311 (Cuba). Sardinella pinnula Bean, 1912:122 (Bermuda); FWNA, 1964:400, fig. 98 (synonymy, biol.); Sardinella aurita:Whitehead, 1973a:27, fig. 6 (Guianas).

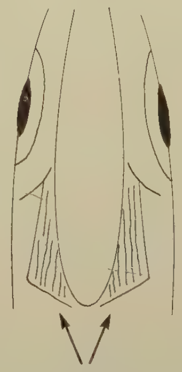
FAO Names : En - Round sardinella.



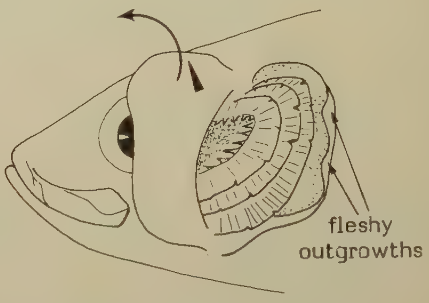
Diagnostic Features: Body elongate, usually subcylindrical, but sometimes a little compressed; belly rather rounded, but scutes apparent. Lower gillrakers fine and numerous, more than 80 (162 to 248 in West African specimens of 23 to 28 cm standard length); anterior gillrakers on lower limbs of second and third gill arches lying more or less flat (strongly curled in S. brasiliensis). The pelvic finray count of i 8 distinguishes S. aurita from all other species of Sardinella, also Harengula, Opisthonema, Herklotsichthys and Amblygaster, that occur with it. Resembles Clupea, but has two fleshy outgrowths along outer margin of gill opening (smooth in Clupea) and numerous fine fronto-parietal striae on top of head. Flanks silvery, with a faint golden midlateral line, preceded by a faint golden spot behind gill opening; a distinct black spot at hind border of gill cover (absence of silver pigment). See CLUP Sardl 1, Fishing Areas 37, 34 and 47 (in part), 31.



lower limbs of gill arches

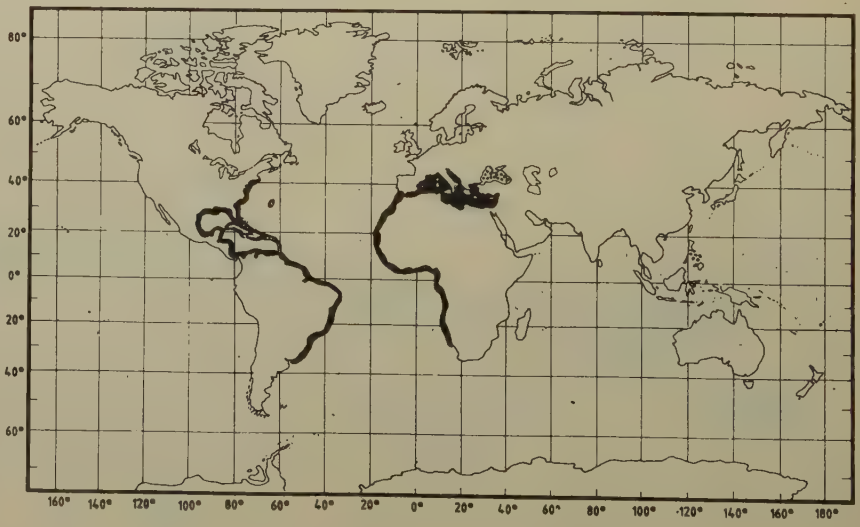


fronto-parietal striae on top of head



Geographical Distribution: Eastern Atlantic (Mediterranean, but rare in Black Sea; African coasts from Gibraltar southward to Saldanha Bay, South Africa (see also under remarks); western Atlantic (Cape Cod to Argentina).

Habitat and Biology: Coastal, pelagic, preferring clear saline water with a minimum temperature below 24°C; from inshore and near surface to edge of shelf and down to 350 m (West Africa), or perhaps even deeper; schooling and strongly migratory, often rising to surface at night and dispersing. Feeds mainly on zooplankton, especially copepods, but some phytoplankton (especially by juveniles). Breeds perhaps at all times of the year (e.g. off West



Africa), but with distinct peaks, e.g. mid-June -end of September, i.e. the summer months, in the Mediterranean and perhaps off North America; from about May off Senegal (but again in October-November) through to July-August off Mauritania; around July or August off Ivory Coast and Ghana; but apparently September to February, i.e. the winter months, in the Gulf of Mexico (Houde & Fore, 1973), January-February off Venezuela (Simpson, 1969), and, if it spawns with S. brasiliensis, then September to March off Brazil. The breeding pattern is extremely complex, with two principal spawning periods in some areas (linked with upwelling regimes off West Africa). The juveniles tend to stay in nursery areas (main nurseries off Mauritania and Senegal/Gambia for the West African region), but on maturity rejoin adult stocks in the colder offshore waters.

Size : To 30 cm standard length, usually to 25 cm.

Interest to Fisheries : Major fisheries off West Africa, in Mediterranean and off Venezuela and Brazil, although catches not always distinguished from those of other Sardinella species (especially of S. brasiliensis in western Atlantic). The total catch for 1983 was 702 775 tons, being 15 209 tons for the Mediterranean (mixed with S. maderensis), 401 039 tons for West Africa (mixed with S. maderensis) and 286 527 tons for the western Atlantic (mixed with S. brasiliensis).

Local Names : USA (Florida): Spanish sardine.

Literature : For eastern Atlantic area, Svetovidov (1952, 1963 - Mediterranean, Black Sea); Ben-Tuvia (1960 - general synopsis); Postel (1960 - synopsis, West Africa); Banarescu (1964 - Black Sea); Fagetti & Marak (1972 - synopsis of spawning off West Africa); Anon. (1979 - same, also growth, fecundity); Boely & Fréon (1980 - same); FNAM (1984 - synopsis); CLOFETA (in press - virtually complete bibliography for West Africa). For western Atlantic area, Hildebrand (i.e. FWNA, 1964).

Remarks : The separation of S. aurita from S. brasiliensis by means of gillrakers shape (see diagnostic features) is tentative; it appears to reinforce the difference in gillrakers numbers (more in S. brasiliensis, but in both cases they increase as the fish grows) which workers have hitherto used. The 'brasiliensis' curled form of gillrakers has been found also in both Mediterranean and West African fishes. Possibly this is a racial difference, which might account for the double peaks in spawning in some areas. The species has been best studied off West Africa, where there are three quite distinct 'stocks':

(i) North Transitional Zone (Mauritania to Guinea; also, off Sierra Leone - perhaps a separate stock)
(ii) Central Upwelling Zone (Ivory Coast, also Ghana)
(iii) South Transitional Zone (southern Gabon to southern Angola).

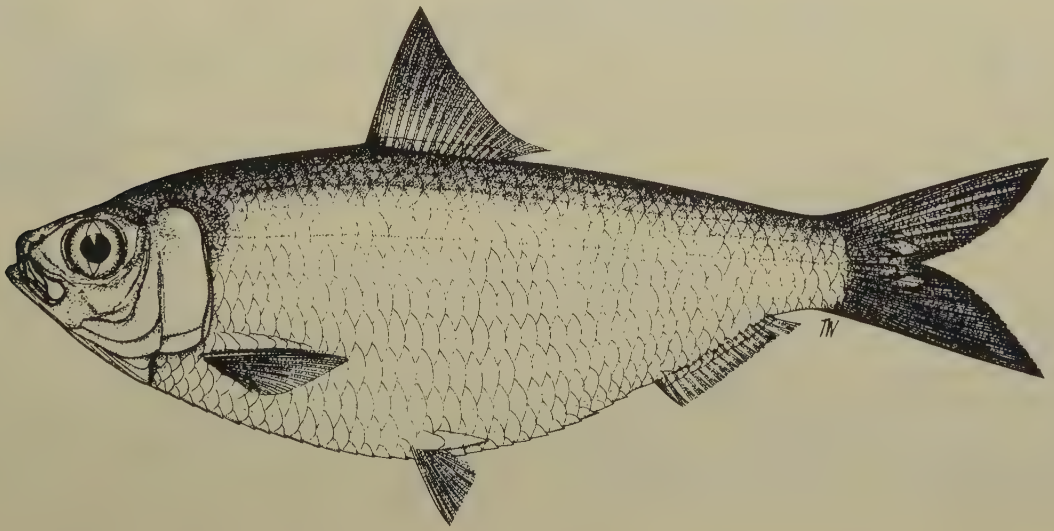
Sardinella brachysoma Bleeker, 1852

CLUP Sardl 5

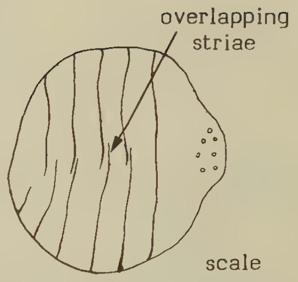
Sardinella brachysoma Bleeker, 1852, Verh.batav.Genoot.Kunst.Wet., **24**:19 (Batavia).

Synonyms : Harengula hypselosoma Bleeker, 1855:427 (Amboina); Meletta schlegelii Castelnau, 1873:93 (Darwin); Sardinella albella:Fowler, 1941:605 (incorrect synonymy); Sardinella brachysoma - Chan, 1965:19, fig. 9 (India; but China, Hong Kong specimens probably S. hualiensis); Whitehead et al., 1966:49 (types of brachysoma, hypselosoma); Whitehead, 1973b:182, fig. 12; Wongratana, 1980:127, pls 67, 68 (revision).

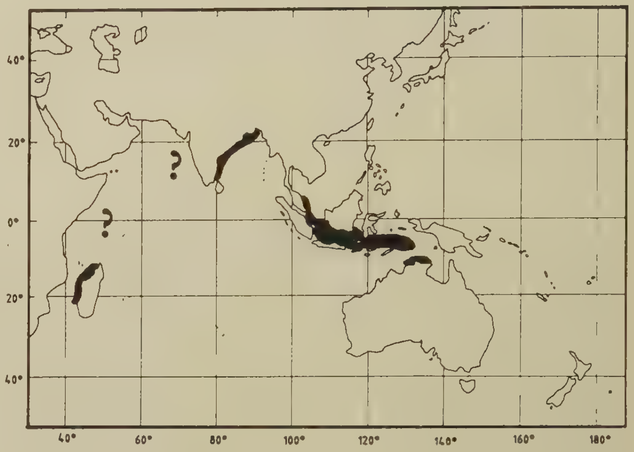
FAO Names : En - Deepbody sardinella.



Diagnostic Features : Body deep and compressed, its depth 30 to 39% of standard length; total scutes 29 to 32. Lower gillrakers 48 to 67, hardly increasing with size of fish. Vertical striae on scales overlapping or sometimes continuous at centre of scale, numerous small perforations on hind part of scale. A dark spot at dorsal fin origin. Closely resembles S. hualiensis of China, which has dark dorsal and caudal fin tips. Differs from other deep-bodied species with overlapping or continuous scale striae chiefly in its lower gillraker count (87 to 134 in S. filiense, 88 to 126 in S. dayi) and presence of a dark spot at dorsal fin origin (absent in S. richardsoni and S. zunasi). See CLUP Sardl 5, Fishing Areas 57, 71.



Geographical Distribution : Indo-West Pacific (Madadagascar, but apparently not elsewhere in the western Indian Ocean; Madras, Indonesia, northern Australia; Chan's Hong Kong and Taiping specimens were most likely S. hualiensis).



Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 13 cm standard length, usually to 12 cm.

Interest to Fisheries : Included in the general statistics for Sardinella; probably of some local importance in parts of Indonesia.

Local Names : -

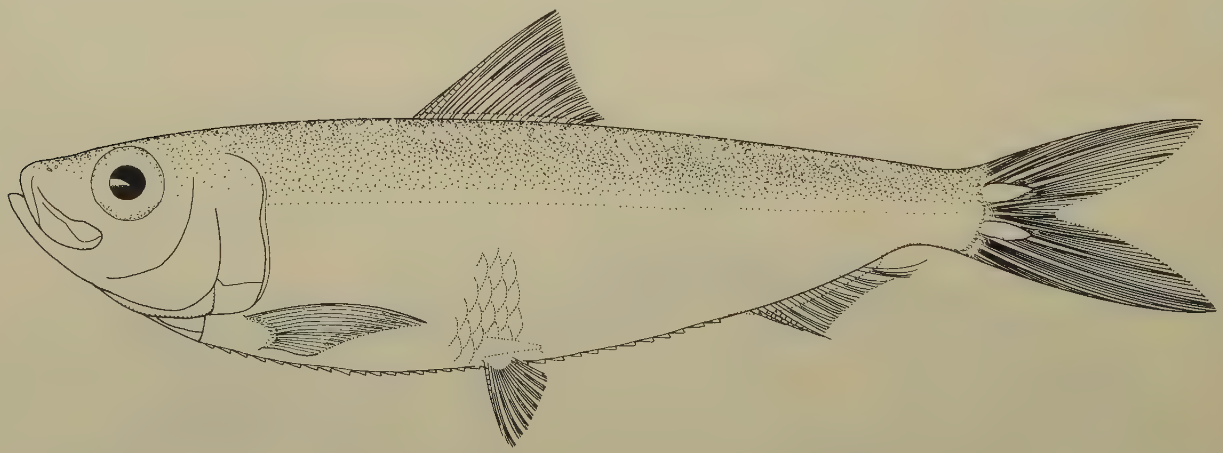
Sardinella brasiliensis (Steindachner, 1879)

CLUP Sardl 11

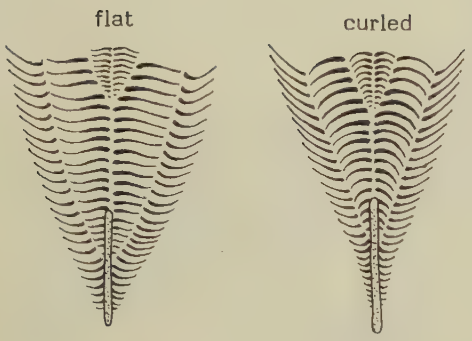
Clupea brasiliensis Steindachner, 1879, Sber.Akad.Wiss.Wien, **80**:182 (Rio de Janeiro).

Synonyms : Clupea janeiro Eigenmann & Bray, 1849, Ann.N.Y.Acad.nat.Sci.:626 (replacement name in view of the homonym Clupea brasiliensis Schneider, 1801 = Albula vulpes Linnaeus, 1758; the name janeiro seems never to have been adopted and although corect should be rejected on grounds of usuage); Sardinella brasiliensis - FWNA, 1964:407, fig. 101; Whitehead, 1973a:30 (Guianas).

FAO Names : En - Brazilian sardinella.

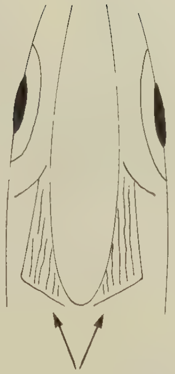


Diagnostic Features : See Sardinella aurita, from which it differs in having the anterior gillrakers on the lower limbs of the second and third gill arches distinctly curled downward (more or less flat in S. aurita. The pelvic finray count of i 8 distinguishes S. brasiliensis from all other species of Sardinella, also Harengula and Opisthonema. Resembles Strangomera of Argentina and Chile, but has two fleshy appendages along outer margin of gill opening (smooth in Strangomera) and numerous fine fronto-parietal striae on top of head. See CLUP Sardl 11, Fishing Area 31.

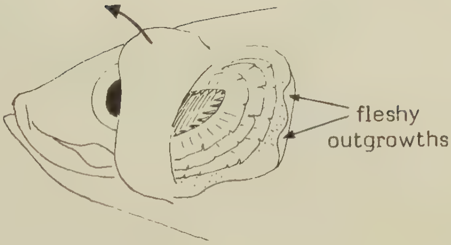


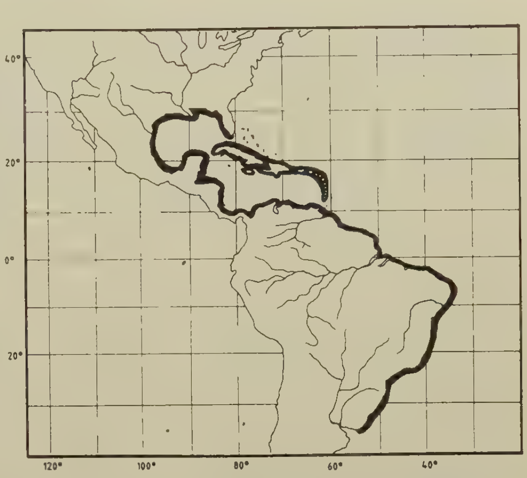
S. aurita *S. brasiliensis*

lower limbs of gill arches



fronto-parietal striae on top of head





Geographical Distribution : Western Atlantic (Gulf of Mexico, Caribbean, West Indies southward to Brazil and northern Uruguay, but identifications not always reliable). See also remarks.

Habitat and Biology : Coastal, pelagic, schooling. Probably similar to *S. aurita*, but if indeed this species is distinct from *S. aurita* then it may account for one of the apparent double spawning peaks of that species.

Size : To 25 cm standard length, usually around 20 cm.

Interest to Fisheries : Large fishery in Venezuela, but statistics do not separate if from *S. aurita*.

Local Names : USA: Orangespot sardine (Florida).

Literature : Included in many of the western Atlantic references to *S. aurita* and perhaps mixed with *S. aurita* even in studies purporting to deal only with *S. brasiliensis* (e.g. Matsuura, 1975, 1977 - southern Brazil, spawning, eggs, larvae; Figureido & Menezes, 1978:23, fig. 27).

Remarks : Separation of *S. brasiliensis* from the widespread *S. aurita* on the basis of gillrakers shape and a higher gillraker count is tentative, the more so since fishes with the *brasiliensis* curled form of gillrakers occur off West Africa and in the Mediterranean.

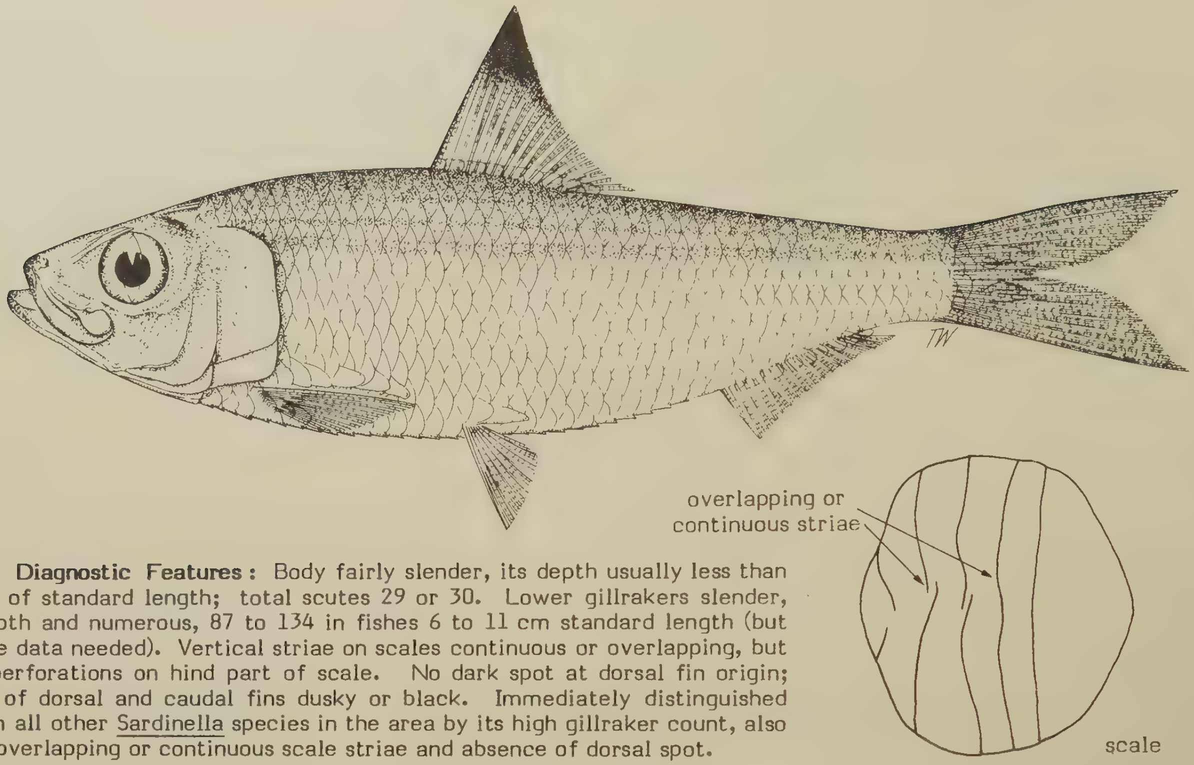
Sardinella fijiense (Fowler & Bean, 1923)

CLUP Sardl 17

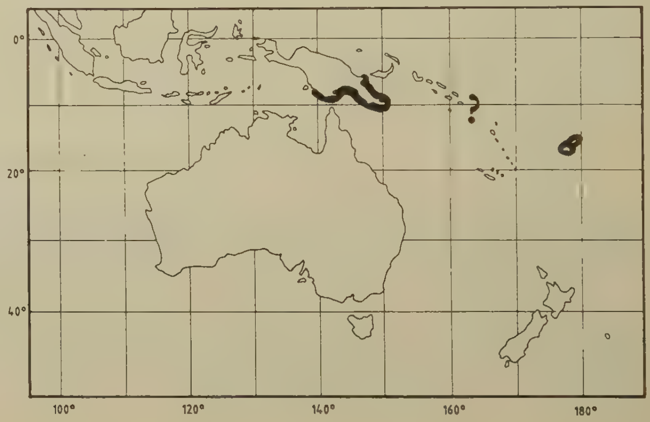
Harengula fijiense Fowler & Bean, 1923, Proc.U.S.natn.Mus., **63**:63 (Fiji).

Synonyms : *Harengula fijiensis* Fowler, 1928:31 (unjustified emendation of name); *Harengula nymphaea*: Fowler, 1941:599, fig. 15 (his *H. fijiensis* in the synonymy; his Fiji material only); *Sardinella fijiense*: Wongratana, 1980:125, pls 61, 62 (revision).

FAO Names : En - Fiji sardinella.



Diagnostic Features: Body fairly slender, its depth usually less than 30% of standard length; total scutes 29 or 30. Lower gillrakers slender, smooth and numerous, 87 to 134 in fishes 6 to 11 cm standard length (but more data needed). Vertical striae on scales continuous or overlapping, but no perforations on hind part of scale. No dark spot at dorsal fin origin; tips of dorsal and caudal fins dusky or black. Immediately distinguished from all other Sardinella species in the area by its high gillraker count, also the overlapping or continuous scale striae and absence of dorsal spot.



Geographical Distribution: Western Pacific (Papua New Guinea, Fiji).

Habitat and Biology: Coastal, pelagic, schooling. More data needed.

Size: To 11.5 cm standard length.

Interest to Fisheries: Presumably contributes to Sardinella catches, but appears not to be abundant.

Local Names: -

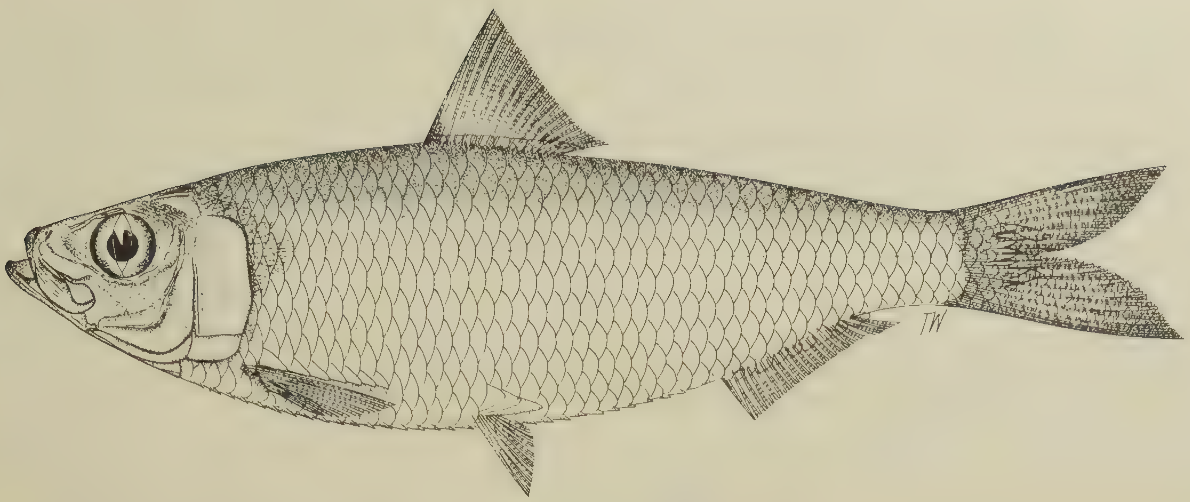
Sardinella fimbriata (Valenciennes, 1847)

CLUP Sardl 7

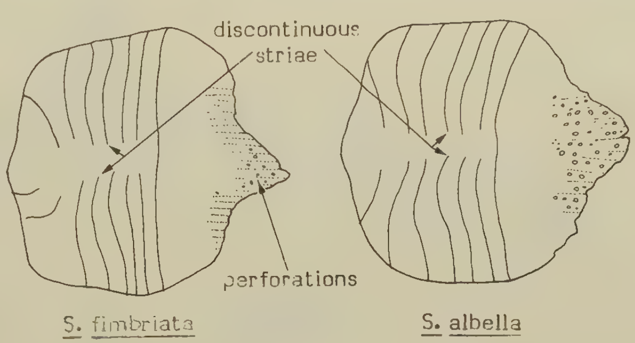
Spratella fimbriata Valenciennes, 1847, Hist.nat.poiss., **20**:359 (Malabar).

Synonyms: Sardinella fimbriata - Fowler, 1941:609 (the Philippines); Chan, 1965:14, fig. 7a (India, Thailand, the Philippines); Whitehead, 1967:50 (type); Whitehead, 1973b:184, fig. 14 (but not the Western Indian Ocean records); Wongratana, 1980:119, pls 56, 57 (revision); Whitehead & Bauchot, in press (types of S. fimbriata).

FAO Names: En - Fringescale sardinella.



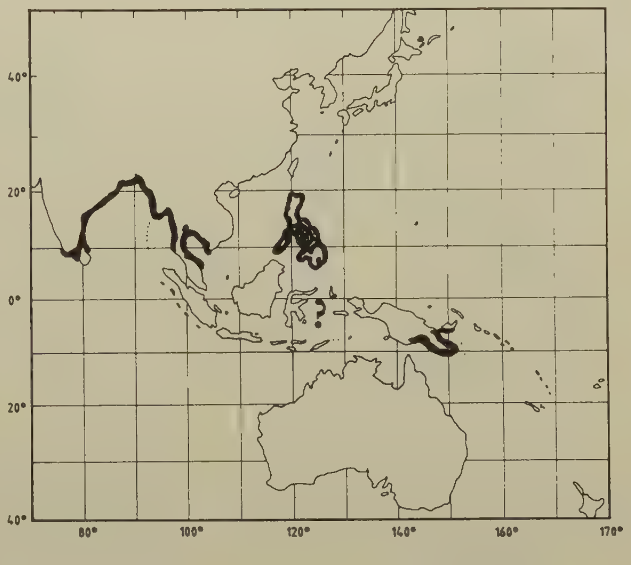
Diagnostic Features : Body somewhat compressed but variable, from slender to moderately deep, its depth 25 to 34% of standard length; total number of scutes 29 to 33 (usually 30 to 32). Lower gillrakers 54 to 82 (at 5 to 12 cm standard length, increasing with size of fish). Vertebral striae on scales not meeting at centre, hind part of scale with a few perforations and (in Indian Ocean specimens) somewhat produced posteriorly. A dark spot at dorsal fin origin. Closely resembles S. albella, which has fewer lower gillrakers (41 to 68, most specimens less than 60) and many more perforations on the scales. Often confused with S. gibbosa, which has more scutes (32 to 34) and fewer gillrakers (45 to 59). Other similar species have more scutes, or more gillrakers or overlapping scale striae or no spot at dorsal fin base or caudal tips black (or a combination of some of these features). See CLUP Sardl 7, Fishing Areas 57, 71.



S. fimbriata S. albella

scale

Geographical Distribution : Indo-West Pacific (not in western Indian Ocean, but from southern India and Bay of Bengal to the Philippines, also eastern tip of Papua New Guinea).



Habitat and Biology : Coastal, pelagic, schooling. Misidentifications (especially with S. gibbosa in Indian waters and S. albella in the western Indian Ocean) make published biological data potentially unreliable. The biology is summarized by Nair (1960, 1973).

Size : To 13 cm standard length, usually around 11 cm.

Interest to Fisheries : Included in the general statistics for Sardinella, but of some importance in southern parts of India (although fishery statistics probably include S. gibbosa and/or S. albella).

Local Names : INDIA: Chalamathi (Malayalam); Charree addee (Hindi); Erebai, Pedi (Kannada); Hoira, Khaira (Bengali); Noone kavallu (Telegu); Pedwa, Washi (Marathi); Saudai (Tamil). These names are probably equally applied to similar species in many areas.

Literature : Nair (1960, 1973 - India, synopsis of biology and fisheries).

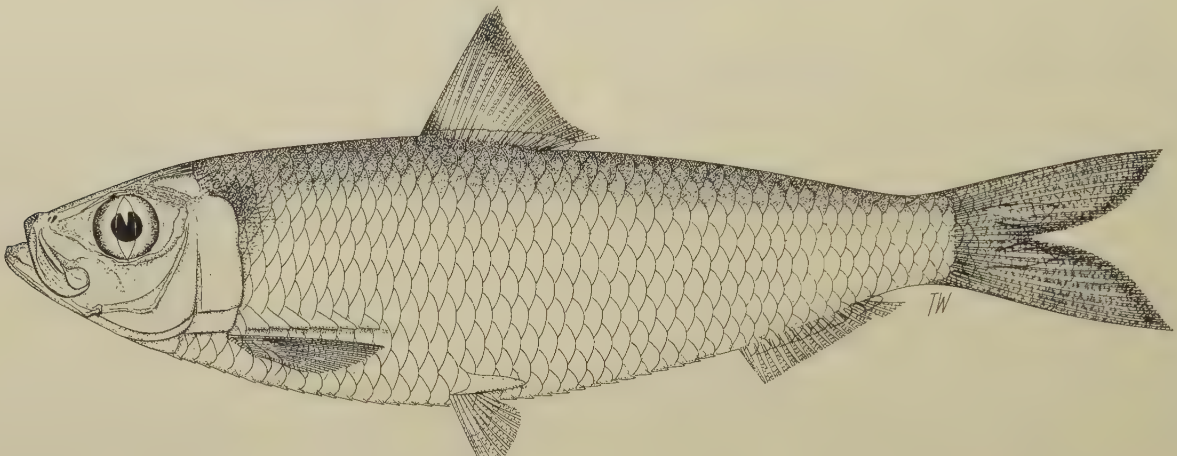
Sardinella gibbosa (Bleeker, 1849)

CLUP Sardl 8

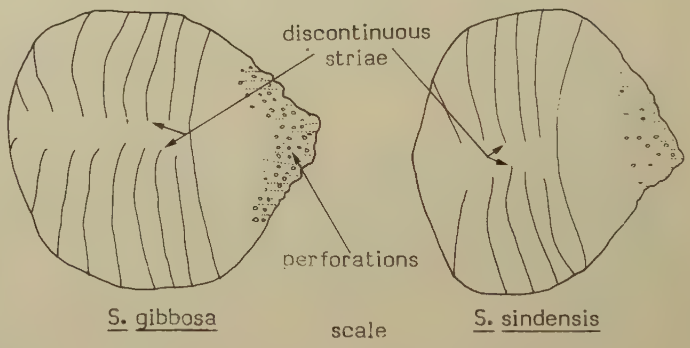
Clupea gibbosa Bleeker, 1849, J.Ind.Arch., 3:72 (Macassar).

Synonyms : Clupanodon jussieu Lacepède, 1803:469, ? pl. 11 (Mauritius; nomen dubium); Spratella tembang Bleeker, 1851:214 (name only to replace Clupea gibbosa); Clupea immaculata Kishinouye, 1907:96, pls 19, fig. 1, 21, fig. 4 (Saga, Kyushu, Amoy, Swatow, China; types destroyed); Sardinia immaculata:Chyung, 1961:135 (Korea); Fimbriclupea dactylolepis Whitley, 1940:399, fig. 5 (northwestern Australia); Sardinella dactylolepis:Munro, 1956:23, fig. 157; Sardinella taiwanensis Raja & Hiyama, 1969:90, pl 26 (Taiwan); Sardinella jussieu:Fowler, 1941:611 (the Philippines); Whitehead, 1965:252 (Gulfs of Aden and Oman); Sardinella jussieui:Chan, 1965:9, fig. 20 (Thailand to Hong Kong); Whitehead et al., 1966:56, 58 (gibbosa, tembang types); Whitehead 1967:54 (jussieu problem); Sardinella gibbosa - Losse, 1968:98 (East Africa); Whitehead, 1973b:185, fig. 15; Wongratana, 1980:117, pls 54, 55 (revision, immaculata identified); SFSA, in press (southern Africa).

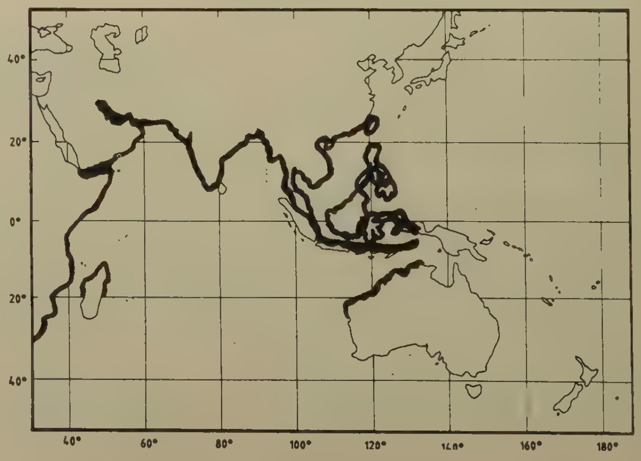
FAO Names : En - Goldstripe sardinella.



Diagnostic Features : Body moderately slender, its depth usually 24 to 30% standard length; total number of scutes 32 to 34. Lower gillrakers 45 to 59 (at 6 to 17 cm standard length, not increasing with size of fish after 6 cm standard length). Vertical striae on scales not meeting at centre, numerous small perforations on hind part of scale. A golden midlateral line down flank (at least in Gulf of Thailand); dorsal and caudal fin margins dusky; a dark spot at dorsal fin origin. Closely resembles S. sindensis (Arabian Sea and the "Gulf"), which has fewer perforations on the scales. Most often confused with S. fimbriata which has fewer scutes (usually 29 to 32) and more gillrakers (54 to 82). Other similar species have fewer scutes or more gillrakers or overlapping scale striae or deeper bodies or no spot at dorsal fin base or caudal tips black (or a comination of some of these features). See CLUP Sardl 8, Fishing Area 57. (Sheet for Fishing Areas 57, 71 not accurate).



Geographical Distribution : Indo-West Pacific (the "Gulf", but apparently not Red Sea; East African coasts, Madagascar eastward to Indonesia, north to Taiwan and Korea south to northern Australia, possibly also western coasts of Australia). One of the most abundant Sardinella species in the Indo-West Pacific region.



Habitat and Biology : Coastal, pelagic, schooling. Possible or even probable confusion with other species (especially S. fimbriata in Indian waters) makes published biological data potentially unreliable. The biology is summarized by Nair (1973:39 to 48).

Size : To 17 cm standard length, usually to 15 cm.

Interest to Fisheries : Included in the general statistics for Sardinella, but of some importance in southern parts of India (Andhra Pradesh, Tamil Nadu, Kerala) and entering markets throughout southeast Asia. It is usually caught in association with other species of Sardinella.

Local Names : HONG KONG: Hwang lum; INDIA: Chalamathi (Malayalam); Choodai, Nonalai (Tamil); Erebai (Kannada); Kavallu (Telugu); INDONESIA: Tembang; TAIWAN ISLAND: Ju shi sha-tin; THAILAND: Pla lang keo. These names are probably equally applied to similar species in many areas.

Literature : Nair (1960, 1973 - India, synopsis of biology and fisheries); Losse (1968 - East Africa); Okera (1974 - East Africa).

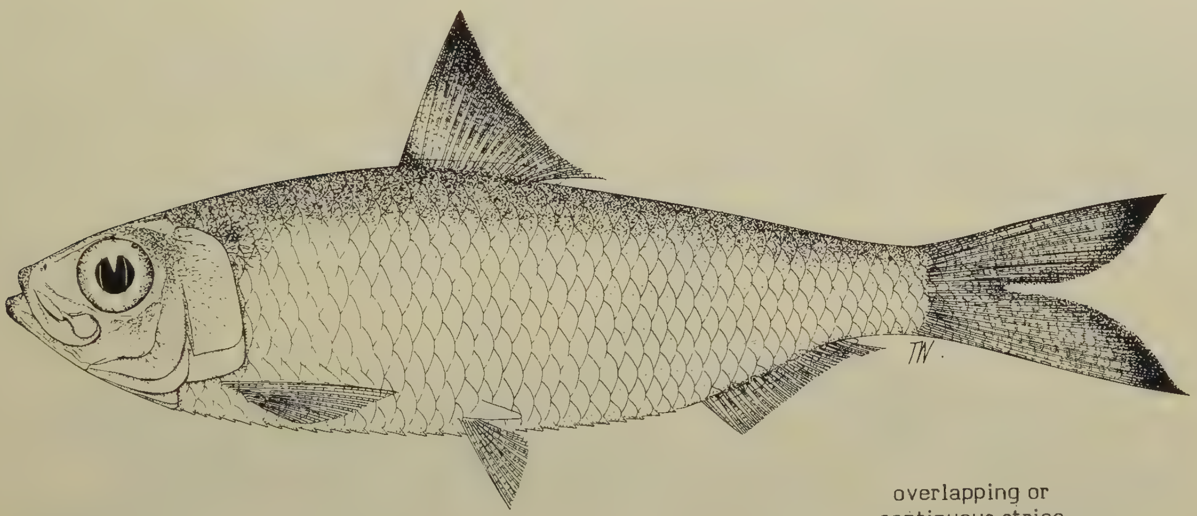
Sardinella hualiensis (Chu & Tsai, 1958)

CLUP Sardl 18

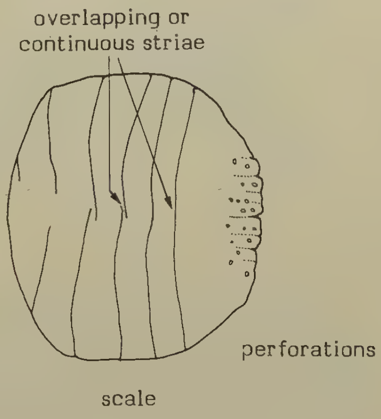
Harengula hualiensis Chu & Tsai, 1958, Quart.J.Taiwan Mus., **11**(1-2):116, pl. 3, figs 2, 3, 4 (Hualien, Taitung, east coast of Taiwan Island).

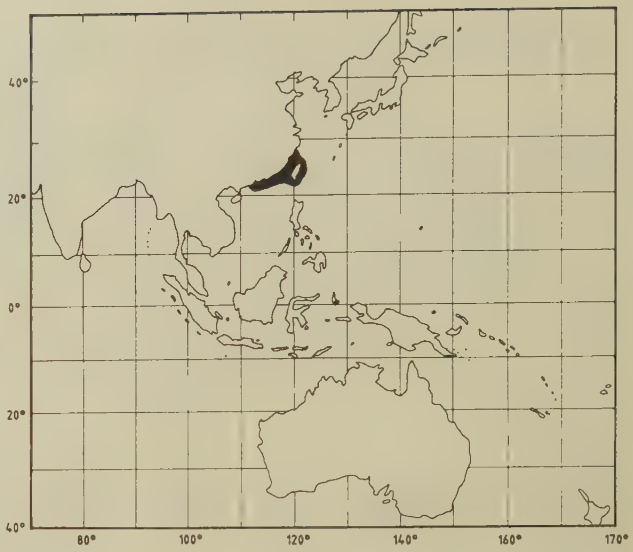
Synonyms : Sardinella brachysoma:Chan, 1965:19 (the China and perhaps Hong Kong specimens); Sardinella hualiensis:Wongratana, 1980:126, pls 65, 66 (revision).

FAO Names : En - Taiwan sardinella.



Diagnostic Features : Body moderately deep and compressed, its depth 29 to 34% of standard length; total scutes 30 to 32. Lower gillrakers 51 to 66, hardly increasing with size of fish. Vertical striae of scales overlapping or sometimes continuous at centre of scale, numerous small perforations on hind part of scale. Tips of caudal fin lobes black. Closely resembles S. brachysoma from Indonesia, etc., which does not have black caudal fin tips. From other deep-bodied species in the area which have overlapping or continuous scale striae it differs in having a dark spot at dorsal fin origin (absent in S. richardsoni and S. zunasi).





Geographical Distribution : Western Pacific (Taiwan Island, possibly south to Hong Kong).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 12.5 cm standard length, usually to about 10 cm.

Interest to Fisheries : Probably makes a small local contribution to Sardinella catches.

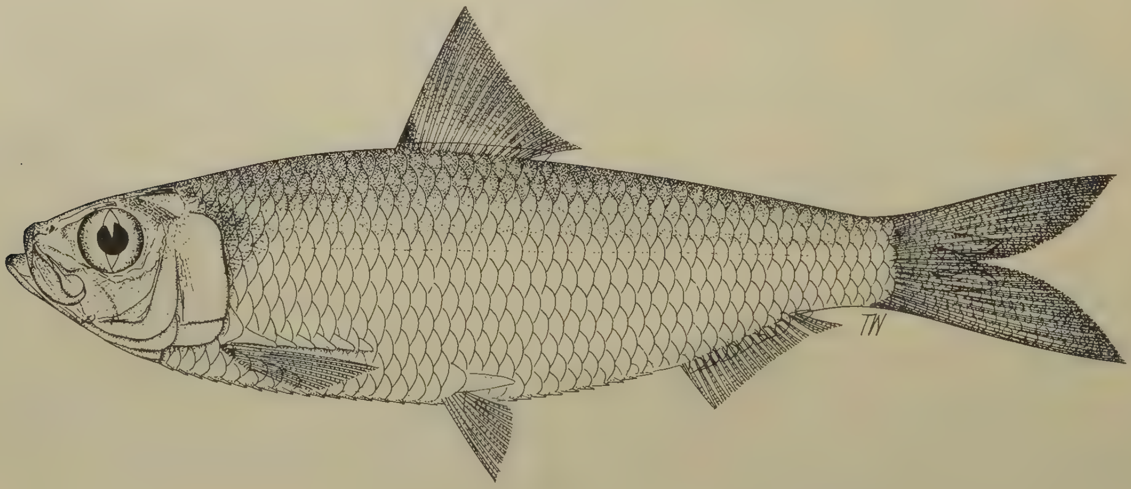
Local Names : -

Sardinella jussieui (Valenciennes, 1847) CLUP Sardl 19

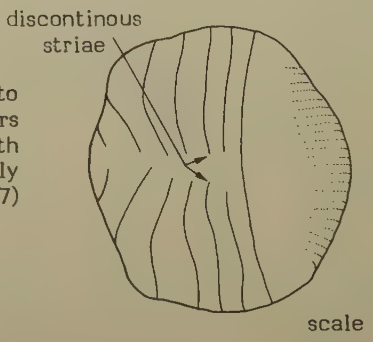
Clupeonia jussieui Valenciennes, 1847, Hist.nat.poiss., **20**:346, pl. 599 (Mauritius).

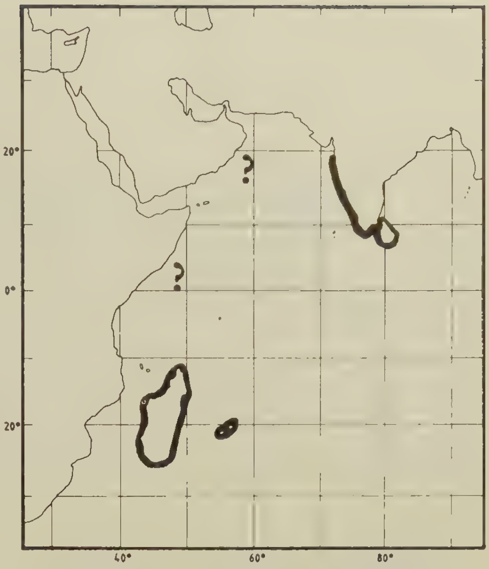
Synonyms : Clupeonia jussieui:Sauvage, 1891:495 (Madagascar); Sardinella dayi Regan, 1917:381 (India); Chan, 1965:12, fig. 22 (Ceylon); Whitehead, 1973b:181, fig. 10; Raja & Lazarus, 1975:114, figs 1, 2 (Karwar, Tuticorin, Vizhinjam); Wongratana, 1980:124, pl. 60 (revision); Sardinella jussieui:Whitehead, 1967:59 (type); Idem, 1973b:181, fig. 11; Wongratana, 1980:114, pls 50, 51 (revision). Note: the Calicut specimens of Fowler (1941:604, fig. 16) are Hilsa kelee; Whitehead & Bauchot, in press (type of jussieui).

FAO Names : En - Mauritian sardinella.



Diagnostic Features : Body compressed and deep, its depth 28 to 37% of standard length; total numbers of scutes 31 or 32. Lower gillrakers 88 to 126 (in fishes 9.5 to 11 cm standard length, strongly increasing with size of fish). Vertical striae on scales not meeting at centre. The only other species of Sardinella with such a high gillraker count (more than 87) is S. fijiense (black caudal tips, western Pacific).





Geographical Distribution : Indo-West Pacific (western coasts of southern India, from Bombay south to Sri Lanka; also to Madagascar, Mauritius).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 12 cm standard length, usually to about 10 cm.

Interest to Fisheries : Enters markets in southern India (e.g. at Cochin), but probably not sufficiently abundant to make any significant contribution to *Sardinella* catches.

Local Names : -

Literature : See under synonyms.

Remarks : All meristic counts of *S. dayi* of southern India overlap those of *S. jussieui* of Mauritius. Wongratana (1980:45 - key) separated the two on scute counts, but his counts do not support this (30 to 32 *versus* 31 or 32). There is a great variation in body depth, even in specimens from the same batch, and a similar variation in gillrakers numbers. More material should be studied.

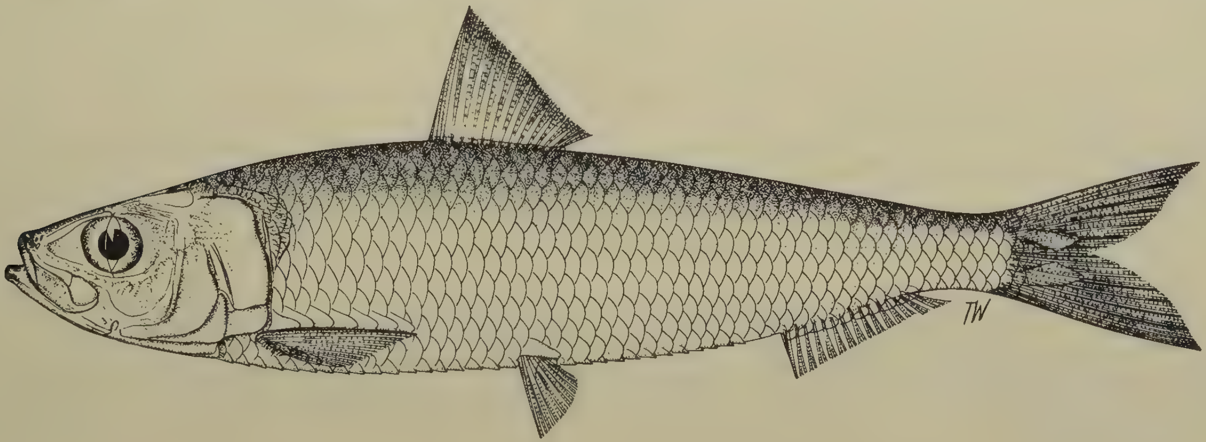
Sardinella lemuru Bleeker, 1853

CLUP Sardl 14

Sardinella lemuru Bleeker, 1853, *Natuurk.Tijdschr.Ned.-Indië*, **4**:500 (Batavia).

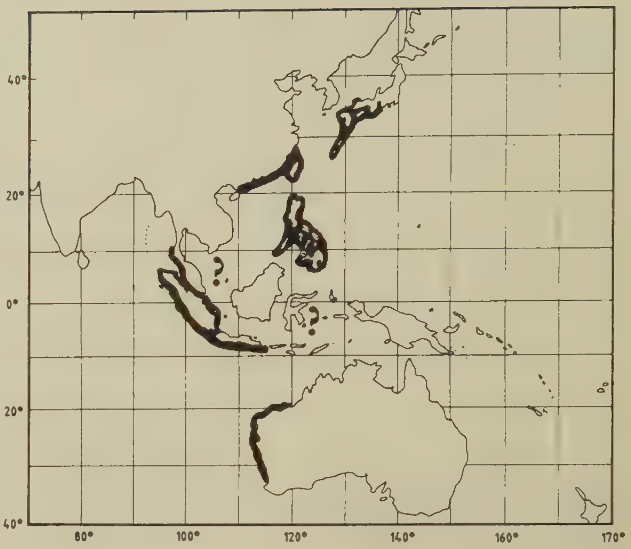
Synonyms : *Clupea nymphaea* Richardson, 1846, *Ichthyol.China Japan*:304 (China Sea) (name suppressed by International Commission in 1970, Opinion 901, *Bull.Zool.Nomencl.*, 26(5-6):217); *Amblygaster posterus* Whitley, 1931:144 (Western Australia); *Amblygaster postera*:Munro, 1956:22, fig. 154; *Sardinella samarensis* Roxas, 1934:275, pl. 2, fig. 11 (Samar, the Philippines); *Sardinella longiceps*:Fowler, 1941:603 (Philippine material); Chan, 1965:3, fig. 17 (Philippine material); *Sardinella aurita* Raja & Hiyama, 1969:78 (the Philippines, Hong Kong, Taiwan Island; the Hong Kong specimens designated *S. aurita terrase*, i.e. *terrasae* Lozano y Rey, a supposed West African subspecies); *Sardinella lemuru*:Wongratana, 1980:111, pls 47, 48 (revision). See Remarks for further western Pacific *S. aurita* references.

FAO Names : En - Bali sardinella.



Diagnostic Features : Body elongate, subcylindrical, its depth less than 30% of standard length, belly rounded. The pelvic finray count of i 8 distinguished *S. lemuru* from all other clupeids in the eastern Indian Ocean and western Pacific. Very closely resembles *S. longiceps* (whose range it may overlap in the Andaman Sea), but head shorter (26 to 29% of standard length; cf. 29 to 35% in *S. longiceps*) and lower gillrakers fewer (77 to 188 in fishes of 6.5 to 22 cm standard length; cf. 150 to 253 in *S. longiceps* of 8 to 15.5 cm, usually more than 180). A faint golden spot behind gill opening, followed by a faint golden midlateral line; a distinct black spot at hind border of gill cover (absence of pigment).

Geographical Distribution : Eastern Indian Ocean (Phuket, Thailand, southern coasts of East Java and Bali; Western Australia) and western Pacific (Java Sea north to the Philippines, Hong Kong, Taiwan Island to southern Japan - see Remarks).



Habitat and Biology : Coastal, pelagic, schooling, strongly migratory. Feeds on phytoplankton, also zooplankton (chiefly copepods). In the Bali region spawning probably occurs at the end of the annual rainy season migration into the Bali Strait (usually September-February, but a peak mainly in December-January, at least judging by numbers caught), but the spawning grounds are not knwon. As in the case of the related species (S. aurita, S. longiceps), spawning and major migrations appear closely linked with hydrological conditions (especially temperature), but sudden appearances or disappearances of shoals have no ready explanation. Spawning in the East China Sea reaches a peak in late March to May, but continues through August.

Size : To 23 cm standard length, usually to 20 cm .

Interest to Fisheries : Of major interest in the East China Sea (100 000 tons in 1971) mainly off southern Fujian and eastern Guandong provinces; and in Indonesia, the bulk of the catch being from the Bali Strait. The total catch in 1983 was 59 980 tons (all from Indonesia).

Local Names : HONG KONG: Hwang tseih; INDONESIA: Lemuru; TAIWAN ISLAND: Hwang sha-tin.

Literature : Soerjodinoto (1960 - biology, fishery); Li Kwan-Ming (1960 - biology, fishery); Ritterbush (1974 - Bali, population biology); Chiu & Tsongchion (1982 - East China Sea, biology fishery).

Remarks : Regan (1917:378) included two Japanese specimens in his wideranging S. aurita, while Fowler (1931:116) included Chinese specimens (Amoy, Swatow, Canton; he later added a Japanese specimen (Fowler, 1941:602 - as S. allecia). It seems much more likely that S. lemuru extends its range northward from the Philippines to China and southern Japan. Much more work is needed before it can be definitely stated that S. lemuru is not merely an eastern form of S. aurita, from which, given the variation in body shape and gillraker numbers in Atlantic S. aurita, it cannot be distinguished as yet on morphological grounds.

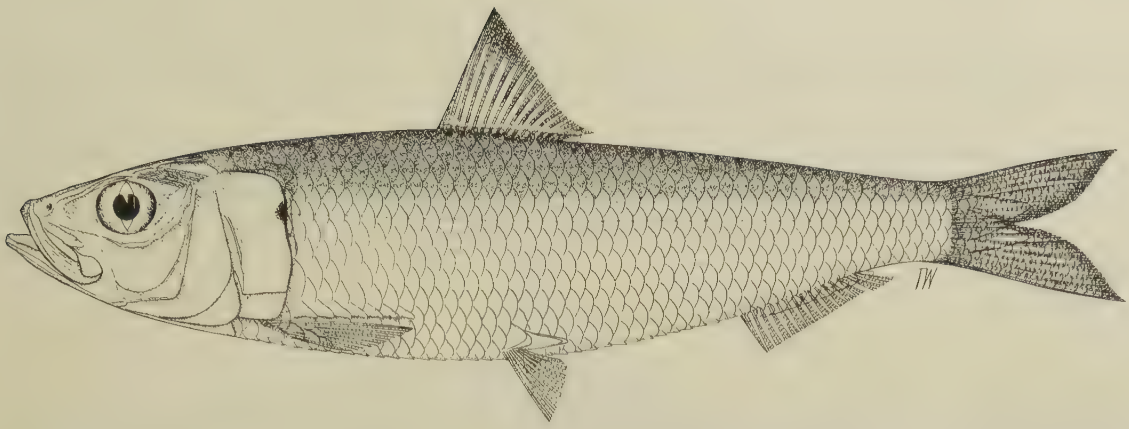
Sardinella longiceps Valenciennes, 1847

CLUP Sardl 3

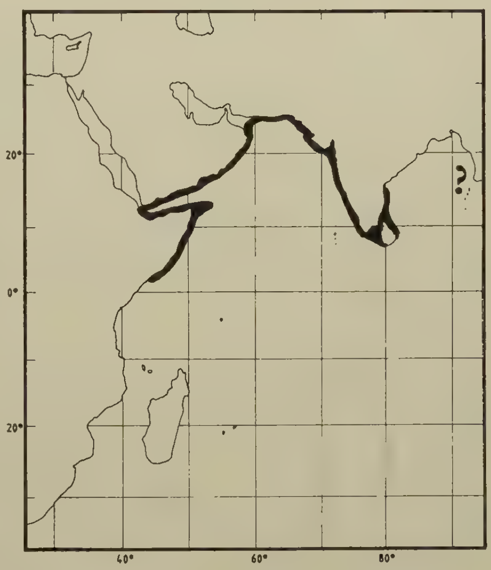
Sardinella longiceps Valenciennes, 1847, Hist.nat.poiss., **20**:273 (Pondicherry).

Synonyms : Sardinella neohowii Valenciennes, 1847, Hist.nat.poiss., 20:274 (Cannanore); Alausa scombrina Valenciennes, 1847, Hist.nat.poiss., 20:442 (Cannanore); Sardinella longiceps - Whitehead, 1965:249 (Gulfs of Aden and Oman, not Red Sea); Chan 1965:3, fig. 17; Whitehead, 1967:44-46 (types of longiceps, neohowii, scombrina); Losse, 1968:96, pl. 1d (East Africa); Whitehead, 1973b:177, fig. 8 (N. Indian Ocean records only); Nair, 1973:4 (India, synopsis); Wongratana, 1980:108, pts 43, 44 (revision); Whitehead & Bauchot, in press (types of longiceps, neohowii, scombrina).

FAO Names : En - Indian oil sardine.



Diagnostic Features: Body elongate, subcylindrical, its depth less than 30% of standard length, belly rounded. The pelvic finray count of i 8 distinguishes S. longiceps from all other clupeids in the northern Indian Ocean. Very closely resembles S. neglecta of East African coasts, but head longer (29 to 35% of standard length; cf. 26 to 29% in S. neglecta) and more lower gillrakers (150 to 253 in fishes of 8 to 15.5 cm standard length, usually more than 180; cf. 143 to 188 in S. neglecta of 9.5 to 13 cm standard length, usually less than 185). Distinguished in the same way from S. lemuru (whose range it may overlap in the Andaman Sea), but the latter has even fewer gillrakers (77 to 188 in S. lemuru of 6.5 to 22 cm standard length). A faint golden spot behind gill opening, followed by a faint golden midlateral line; a distinct black spot at hind border of gill cover (absence of pigment).



Geographical Distribution: Indian Ocean (northern and western parts only, Gulf of Aden, Gulf of Oman, but apparently not Red Sea or the "Gulf", eastward to southern part of India, on eastern coast to Andhra; possibly to Andamans).

Habitat and Biology: Coastal, pelagic, schooling, strongly migratory. Feeds mainly on phytoplankton (especially diatoms), both as juveniles and adults, but also on zooplankton (especially copepods by the juveniles). Breeds once a year, the spawners arriving off western coasts of India in June-July when temperatures and salinity are low during the southwest monsoon months; an extended spawning season, but most intense in August-September; exact spawning grounds not located (Nair, 1973:18 - who summarized the biology of the species).

Size: Perhaps to 23 cm standard length, usually to 20 cm.

Interest to Fisheries: The most important and abundant clupeoid in Indian waters (up to 30% of all marine fishes), although with considerable variations in catches from year to year, e.g. 7 400 tons in 1956, but 189 000 tons in 1960 (Jhingran, 1982:527). The total catch for 1983 402 586 tons, of which 350 260 tons came from India.

Local Names: INDIA: Mathi (Malayalam), Boothai (Kannada), Taralai, Haid (Marathi).

Literature: Nair (1960, 1973 - the best summary of biological data); other references to biological studies summarized by Whitehead (1973b:178).

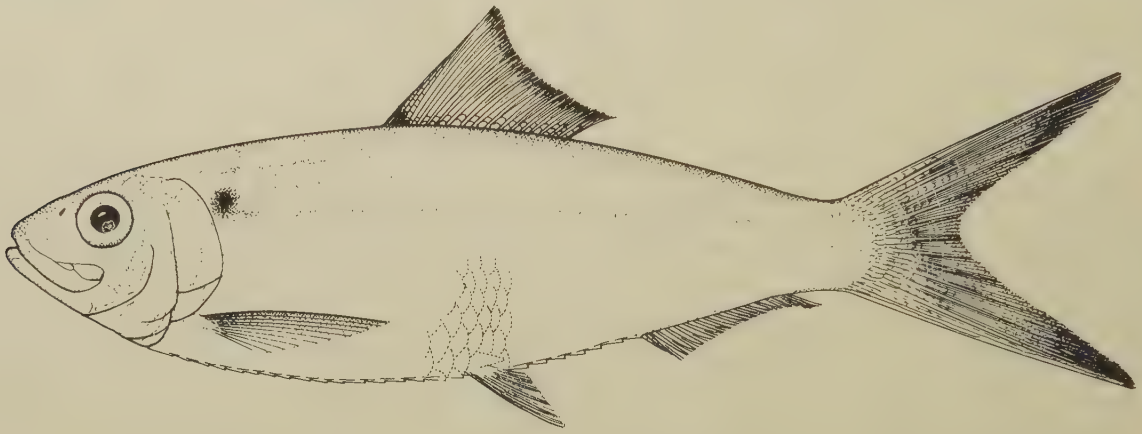
Sardinella maderensis (Lowe, 1839)

CLUP Sardl 2

Clupea maderensis Lowe, 1839 (June), Trans.zool.Soc.Lond., 2(3):189 (Madeira) (wrongly dated 1841 in some publications, e.g. CLOFNAM).

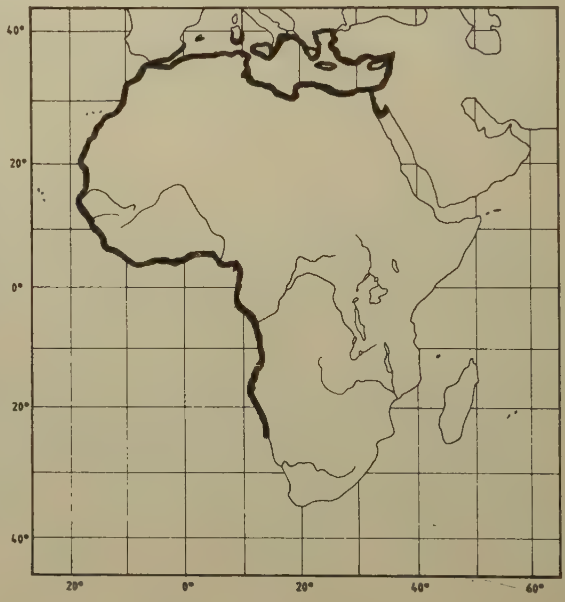
Synonyms : Sardinella granigera Valenciennes, 1847:267 (Egypt); Alausa eba Valenciennes, 1847:417 (Gorée, Senegal); Pellonula modesta Fischer, 1885 (Elobey, Equatorial Guinea); Sardinella cameronensis Regan, 1917:380 (Cameroon); Sardinella maderensis:Ben-Tuvia, 1960:499 (synopsis); Whitehead, 1967:47, 49 (types of granigera, eba); CLOFNAM, 1973:103 (synonymy); FNAM, 1984:223 (synopsis); CLOFETA, in press (complete bibliography); SFSA, in press (southern Africa); Whitehead & Bauchot, in press (types of granigera, eba).

FAO Names : En - Madeiran sardinella.



Diagnostic Features : Body elongate, but variable in depth, belly fairly sharply keeled; total scutes 31 to 34. Lower gillrakers 70 to 166 (in fishes 6 cm standard length or more). Upper pectoral finrays white on outer side, the membrane between black. Resembles S. aurita, but pelvic finrays i 7 (i 8 in S. aurita) and no black spot on hind part of gill cover (but faint gold or black area just behind gill opening). Distinguished from S. rouxi by having more lower gillrakers (only 30 to 40 in S. rouxi) and the caudal fin grey, its tips almost black (yellow in S. rouxi). See CLUP Sardl 2, Fishing Area 34.

Geographical Distribution : Mediterranean (southern and eastern parts, also penetrating Suez Canal); eastern Atlantic (Gilbraltar southward to Angola and a single recorded specimen from Walvis Bay, Namibia).



Habitat and Biology : Coastal, pelagic, but tolerant of low salinities in estuaries, schooling, preferring waters of 24°C, at surface or at bottom down to 50 m, strongly migratory. Feeds on a variety of small planktonic invertebrates, also fish larvae and phytoplankton. Breeds only once in the year, during the warm season (July-September), in coastal waters. Juveniles and adults show clear north-south migrations in the Gabon-Congo-Angola sector of their range and also in the Sierra Leone-Mauritania sector, each area having nurseries; the movements are correlated with the seasonal upwelling. Migrations in the central part (Ivory Coast-Ghana) are not so marked.

Size : To 30 cm standard length, usually to 25 cm.

Interest to Fisheries : Of considerable importance off West African coasts, but combined with S. aurita in most statistics, partly because the two are often caught together.

Local Names : -

Literature : See under synonyms.

Remarks : Many more West African references in the literature (right up to the present time) give this fish as S. eba; a substantial number use the name S. cameronensis for fishes caught in the Cameroon area. Attempts to distinguish three species, however, remain unconvincing in view of the considerable variation in body depth and, most likely, gillraker numbers.

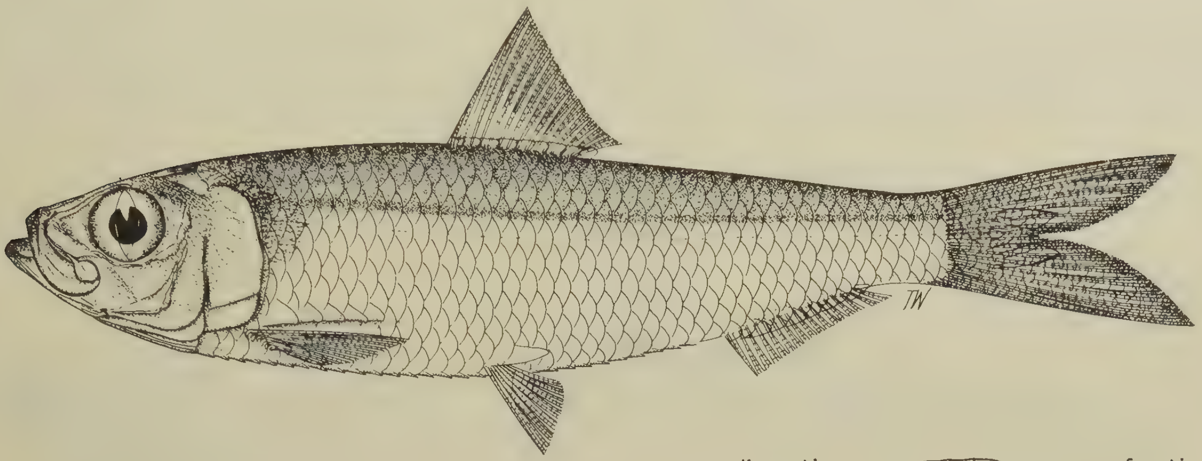
Sardinella marquesensis Berry & Whitehead, 1968

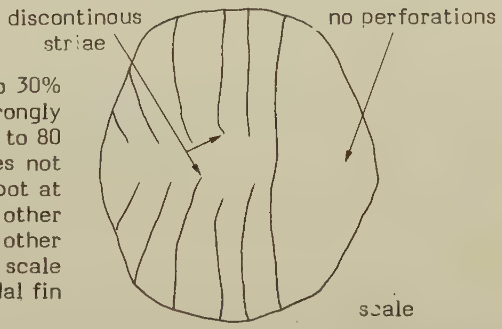
CLUP Sardl 20

Sardinella marquesensis Berry & Whitehead, 1968, Proc.biol.Soc.Wash., **81**:209-222, figs 1-6 (Marquesas Islands).

Synonyms : Sardinella marquesensis:Wongratana, 1980:131, pls 73, 74 (revision).

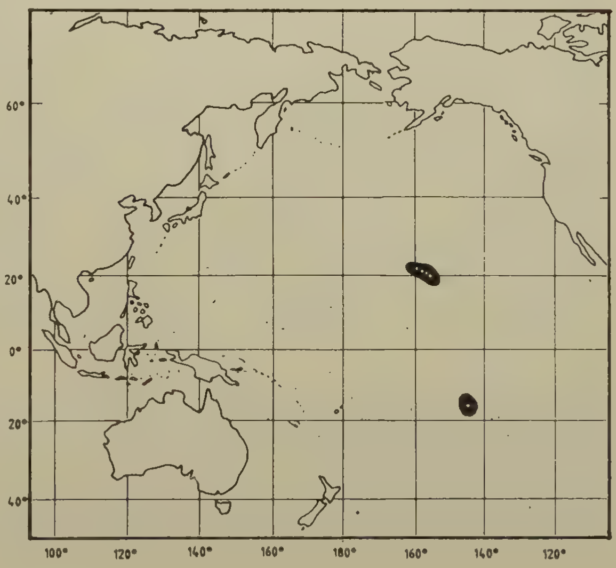
FAO Names : En - Marquesan sardinella.





Diagnostic Features : Body moderately slender, its depth 25 to 30% of standard length; total scutes 28 to 30. Lower gillrakers strongly increasing with size of fish, about 45 at 5 or 6 cm standard length, 50 to 80 at 6 to 10 cm and a maximum of about 80. Vertical striae on scales not meeting at centre, no perforations on hind part of scale. No dark spot at dorsal fin origin, no dark tips to caudal fin. There appear to be no other Sardinella species in the Marquesas area; it can be separated from other species by a combination of characters (slender body, few scutes, scale striae interrupted, many gillrakers, no dark dorsal spot and plain caudal fin tips).

Geographical Distribution : Western Pacific (Marquesas Islands only; more recently (1955) introduced into Hawaiian waters - Murphy, 1960).



Habitat and Biology : Coastal, pelagic, schooling.

Size : To 12.5 cm standard length, usually about 10 cm.

Interest to Fisheries : Used as a baitfish in the Marquesas, but when transported to Hawaii never became sufficiently abundant nor made any significant contribution.

Local Names : -

Literature : Brock (1960 - Hawaii); Murphy (1960 - Hawaii); Hida & Morris (1963 - Hawaii); Nakamura & Wilson (1970 - biology).

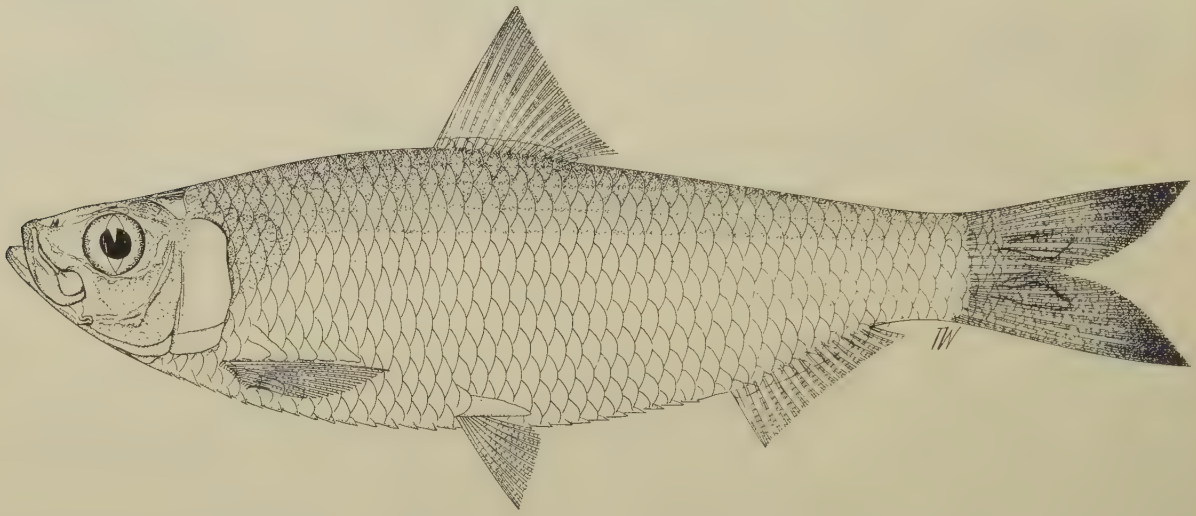
Sardinella melanura (Cuvier, 1829)

CLUP Sardl 4

Clupea melanura Cuvier, 1829, Règne anim., 1st ed., 2:318 (footnote, on Lacepède: "Cl. melanura, N., Lacép. V, xi, 3, sous le nom de Clupanodon Jussieu, mais la description se rapporte à la fig. xi, 3, nommé varieté du Clupanodon chinois") (See discussion in Whitehead, 1967:62).

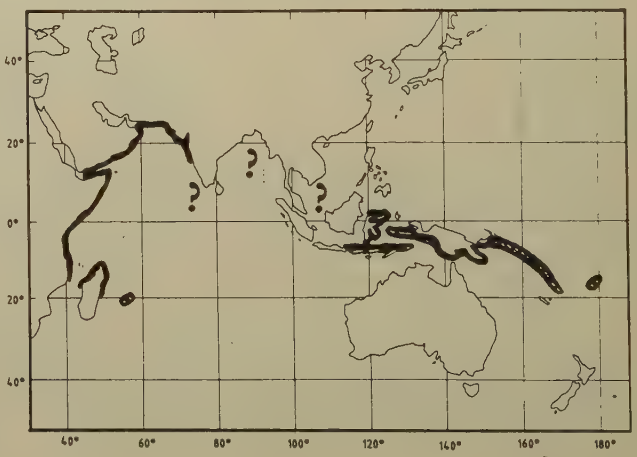
Synonyms : Clupeonia commersoni Valenciennes, 1847:350 (near Bombay); Clupea otaitensis Valenciennes, 1847:351 (on Solander MS name, in synonymy of C. commersoni, thus a nomen nudum); Clupeonia vittata Valenciennes, 1847:352 (Vanikoro); Harengula vanicoris Jordan & Seale, 1906:187 (on Alausa melanura of Valenciennes); Sardinella nigricaudata Chan, 1965:7, fig. 19 (Malakula Island); Herklotsichthys vittatus: Whitehead, 1965:247 (Gulf of Aden): Sardinella melanura:Fowler, 1941:614 (Mauritius, the Philippines, Samoa, Tahiti; Delagoa Bay record needs to be checked); Chan, 1965:5, fig. 18 (Fiji, New Hebrides); Whitehead, 1967:62, 64, 65, 66 (types of melanura, commersoni, otaitensis, vittata); Idem, 1973b:180, fig. 9; Wongratana, 1980:132, pls 75, 76 (revision); Whitehead & Bauchot, in press (types of melanura, commersonii, otaitensis, vittata).

FAO Names : En - Blacktip sardinella.



Diagnostic Features : Body somewhat compressed, its depth usually not much more than 30% of standard length. The jet black caudal tips distinguish S. melanura from all other species of Sardinella except S. atricauda (scutes 32 to 35; cf. 27 to 31, usually 28 to 30 in S. melanura), S. hualiensis (dark spot present at dorsal fin origin, scales fimbriated and with small perforations, recorded so far only from Taiwan Island) and S. fijiense (gillrakers 87 to 134; cf only 38 to 74 in S. melanura). See CLUP Sardl 4, Fishing Area 51, also 57, 71.

Geographical Distribution : Indo-West Pacific (western Indian Ocean from Gulf of Aden south to Madagascar and Mauritius, apparently not south of Bombay nor in northern Bay of Bengal; Indonesia, not South China Sea; eastward to Samoa).



Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 12.2 cm standard length, usually about 10 cm.

Interest to Fisheries : Included in the general statistics for Sardinella; perhaps of local importance, but appears not to be very abundant.

Local Names : INDIA: Sapta tarni (Andaman Islands).

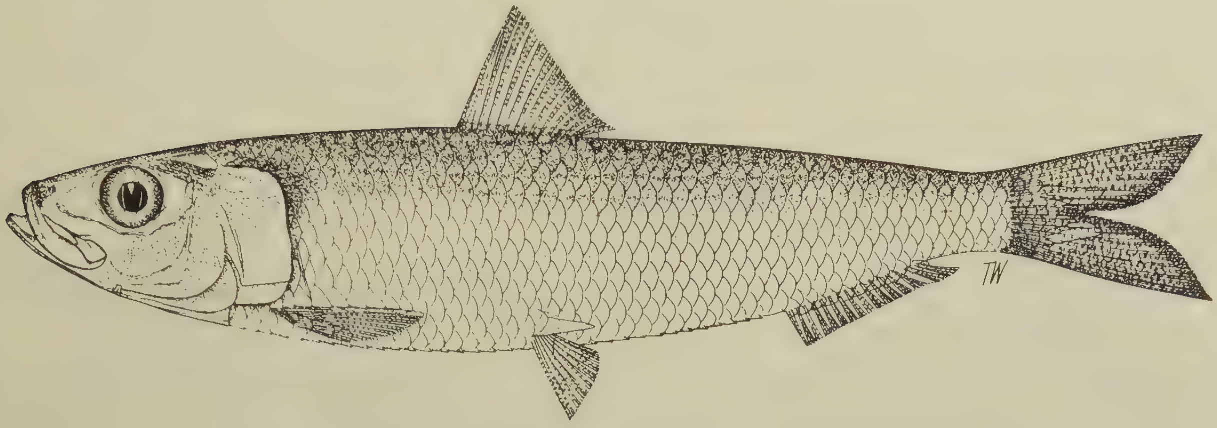
Sardinella neglecta Wongratana, 1983

CLUP Sardl 15

Sardinella neglecta Wongratana, 1983, Jap.J.Ichthyol., **29**(4):390, fig. 4 (Kenya, Tanzania).

Synonyms : Sardinella longiceps (western Indian Ocean only) of authors.

FAO Names : En - East African sardinella.



Diagnostic Features : Body elongate, subcylindrical, its depth less than 30% of standard length, belly rounded. The pelvic finray count of i 8 distinguishes S. neglecta from all other clupeids along the East African coast. Very closely resembles S. longiceps (whose range it may overlap), but head shorter (26 to 29% of standard length; cf. 29 to 35% in S. longiceps) and fewer lower gillrakers (143 to 188 in fishes of 9.5 to 13 cm standard length, usually less than 185; cf. 150 to 253 in S. longiceps of 8 to 15.5 cm standard length, usually more than 180). A faint golden spot behind gill opening, followed by a faint golden midlateral line; a distinct black spot at hind border of gill cover (absence of silver pigment).

Geographical Distribution : Western Indian Ocean (coasts of Kenya and Tanzania).

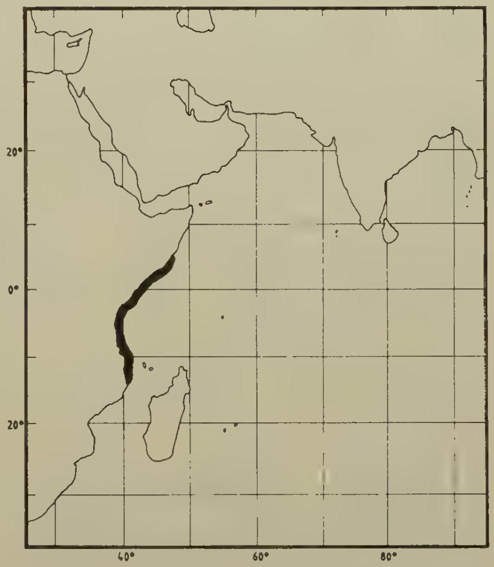
Habitat and Biology : Coastal, pelagic, schooling, in waters of 1 to 60 m, in bays and over shallow banks. Feeds presumably mainly on phytoplankton like S. longiceps and its breeding biology is perhaps similar to that species too.

Size : To 13 cm standard length, but probably grows larger.

Interest to Fisheries : Apparently not abundant, occurring mostly during the northeast monsoon period (November-January).

Local Names : -

Literature : Losse (1968 - taxonomy, biological notes).



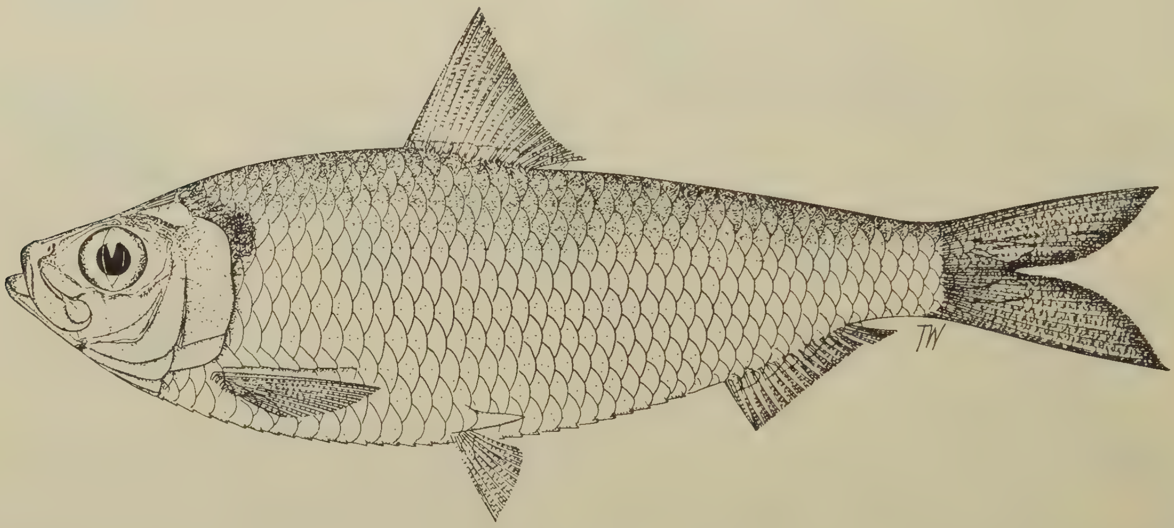
Sardinella richardsoni Wongratana, 1983

CLUP Sardl 22

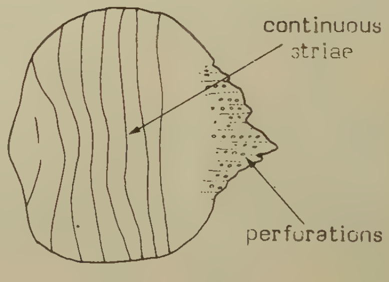
Sardinella (Clupeonia) richardsoni Wongratana, 1983, Jap.J.Ichthyol., **29**(4):390, fig. 5 (replacement name for Clupea isingleena Richardson).

Synonyms : Clupea isingleena Richardson, 1846, Ichthyol.Seas China Japan:304 (China seas) (name suppressed by Int.Comm.Zool.Nomencl. in 1970, Opinion 901, Bull.zool.Nomencl., **26**(5-6):217); Sardinella fimbriata:Whitehead, 1966:24 pl. 1, fig. 2) (type); Sardinella richardsoni:Wongratana, 1980:129, pls 69,70 (revision).

FAO Names : En - Richardson's sardinella.



Diagnostic Features : Body fairly compressed and deep, its depth 32 to 36% of standard length; total scutes 30 to 32. Lower gillrakers 63 to 74, probably not increasing greatly after about 7 cm standard length. Vertical striae on scales continuous or overlapping, numerous small perforations on hind part of scale. No dark spot at dorsal fin origin. Most closely resembles S. zunasi, which has only 42 to 58 lower gillrakers (usually less than 55 in fishes up to 12 cm standard length) and is more slender (depth 24 to 33% of standard length, usually 31% or less). Of other species in the area, S. hualiensis also has overlapping or continuous scale striae, but black tips to dorsal and caudal fins; while S. fimbriata and S. albella have the scale striae interrupted at the centre of the scale.



scale

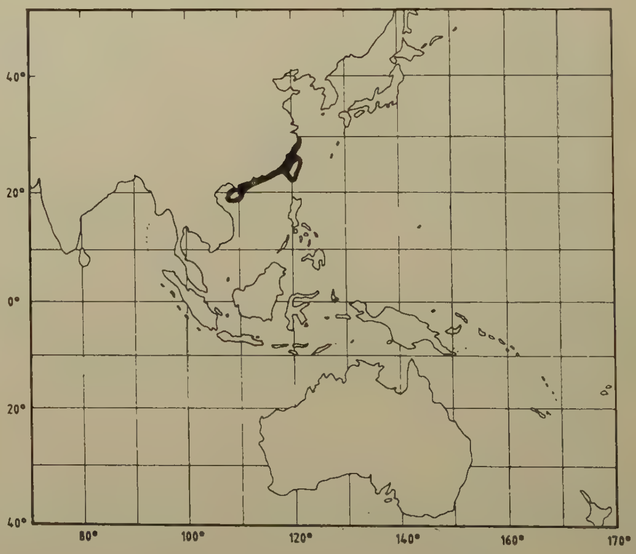
Geographical Distribution : Western Pacific (Hainan Island, Hong Kong, China).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 12 cm standard length, usually to about 10 cm.

Interest to Fisheries : Probably makes a small local contribution to Sardinella catches.

Local Names : HONG KONG: Tsing lein (lin or lun) (fide Richardson, 1846:304).



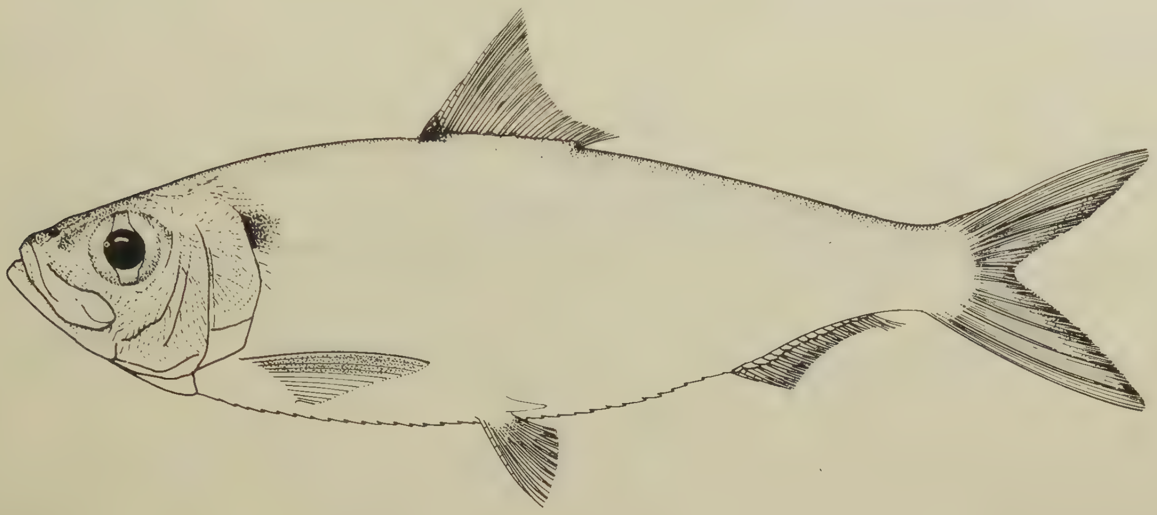
Sardinella rouxi (Poll, 1953)

CLUP Sardl 12

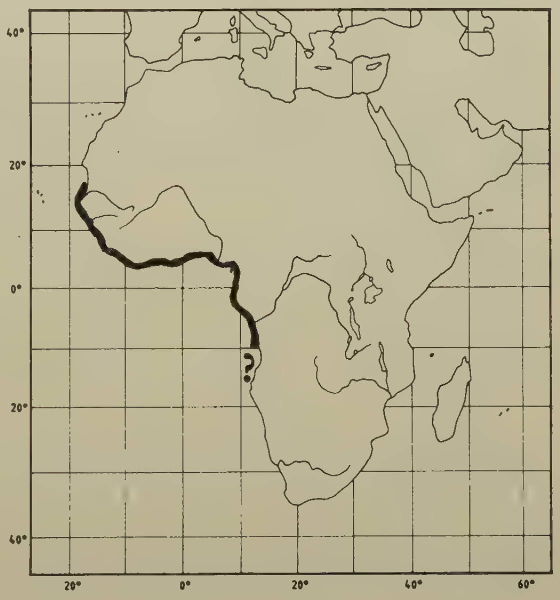
Harengula rouxi Poll, 1953, *Rés.Expéd.belge Atl.Sud.*, 4(2):46, fig. 16 (Cape Lopez Bay, 0°42'S, 8°49'E).

Synonyms : *Harengula macrophthalma*:Roux & Collignon, 1950:27 (key); *Harengula rouxi*:Fagetti & Marak, 1972:5 (eggs, larvae); *Sardinella rouxi*:Whitehead, 1964:273 (not *Harengula* but *Sardinella*); CLOFETA, in press (complete bibliography).

FAO Names : En - Yellowtail sardinella.



Diagnostic Features : Body moderately deep, belly fairly shrply keeled. Lower gillrakers 30 to 40. A black or golden spot behind gill opening; upper part of pectoral fins dusky; caudal fin pale yellow with dusky hind margin. Resembles small *S. maderensis*, which has more gillrakers (70 to 166) and the caudal fin grey, its tips almost black. Distinguished from small *S. aurita* by having i 7 pelvic finrays (i 8 in *S. aurita*) and no black spot on hind part of gill cover. See CLUP Sardl 12, Fishing Area 34.



Geographical Distribution : Eastern Atlantic (Senegal southward to Congo, possibly to northern Angola).

Habitat and Biology : Coastal, pelagic, in inshore waters and along beaches, schooling. More data needed.

Size : To 16 cm standard length, usually around 13 cm.

Interest to Fisheries : Contributes to *Sardinella* catches, but not abundant; no separate statistics.

Local Names : -

Literature : This species is mentioned in less than twenty works (CLOFETA, in press) and more studies are needed. Eggs and larvae are described by Marchal (1965); Krzelj (1971); Fagetti & Marak (1972) and Conand (1979).

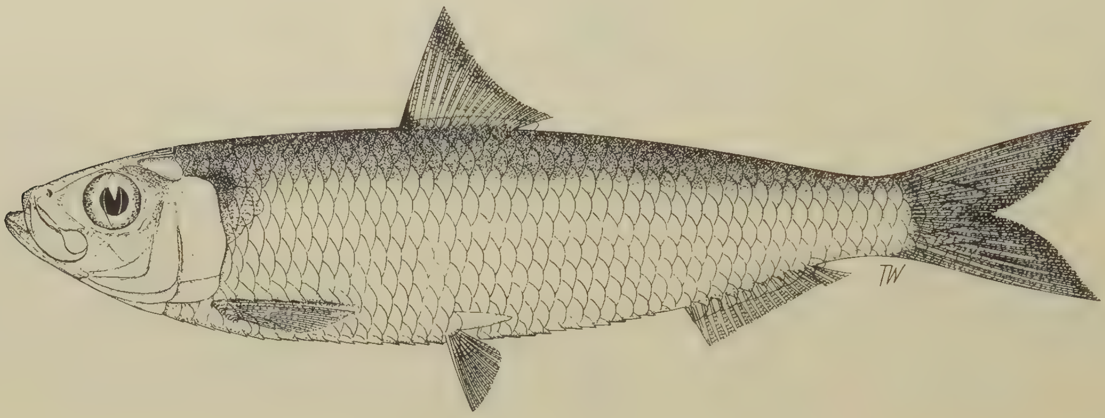
Sardinella sindensis (Day, 1878)

CLUP Sardl 13

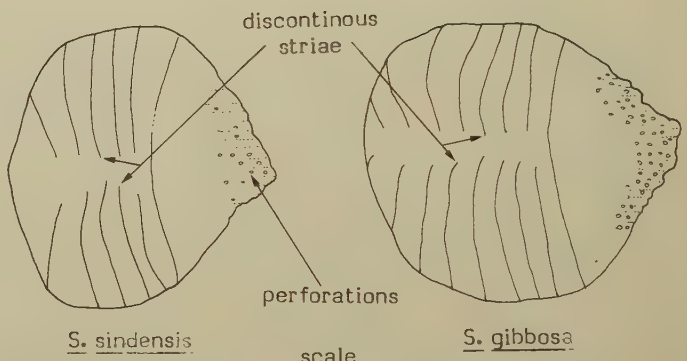
Clupea sindensis Day, 1878, Fishes of India, pt. 4:638, pl. 163, fig. 2 (Karachi).

Synonyms : Sardinella jussieu:Whitehead, 1965:252 (Gulfs of Aden and Oman); Sardinella sindensis:Fowler, 1941:611 (compiled, misleading); Blegvad & Løppenthin, 1944:65 (Gulf of Oman); Whitehead & Talwar, 1971:61 (type); Whitehead, 1973b:186, fig. 16 (Karachi and Bombay records only); Wongratana, 1980:115, pls 52, 53 (revision). Note: the references to S. sindensis by Chan (1965:11, fig. 21) and others probably referred to S. gibbosa, but the two are very close.

FAO Names : En - Sind sardinella.



Diagnostic Features : Body moderately slender, its depth rather variable (21 to 35% of standard length); total numbers of scutes 31 to 34, usually 32 or 33. Lower gillrakers 38 to 77 (more than 50 in fishes over 5 cm standard length, increasing with size of fish). Vertical striae on scales not meeting at centre, only a few small perforations on hind part of scale. Closely resembles the widespread S. gibbosa, which has more perforations on the scales. Of species overlapping the range of S. sindensis, the black caudal tips of S. melanura are distinctive, while S. albella has fewer scutes 29 to 33, but usally 30 to 32. See CLUP Sard 13, Fishing Area 51.



scale

Geographical Distribution : Indo-West Pacific (Arabian Sea, from Gulf of Aden to the "Gulf" and Bombay).

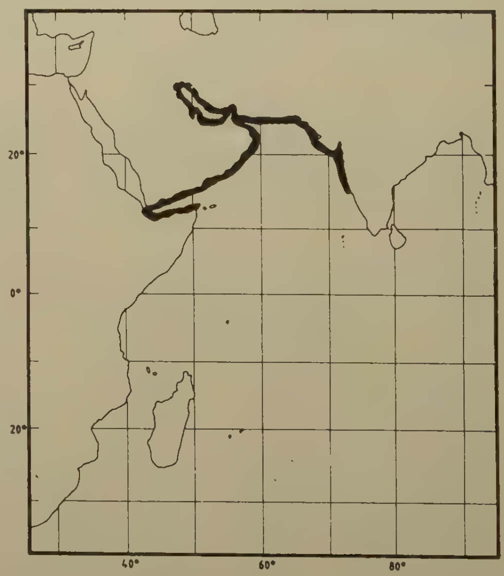
Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 17 cm standard length, common to 14 cm.

Interest to Fisheries : Included in the general statistics for Sardinella; perhaps of some importance in the Gulf of Oman and the "Gulf".

Local Names : THE "GULF": Mashineh, Moomagh (Arab Gulf - Blegvad & Løppenthin, 1944:65).

Literature : Randall, Allen & Smith-Vaniz (1978 - the "Gulf").



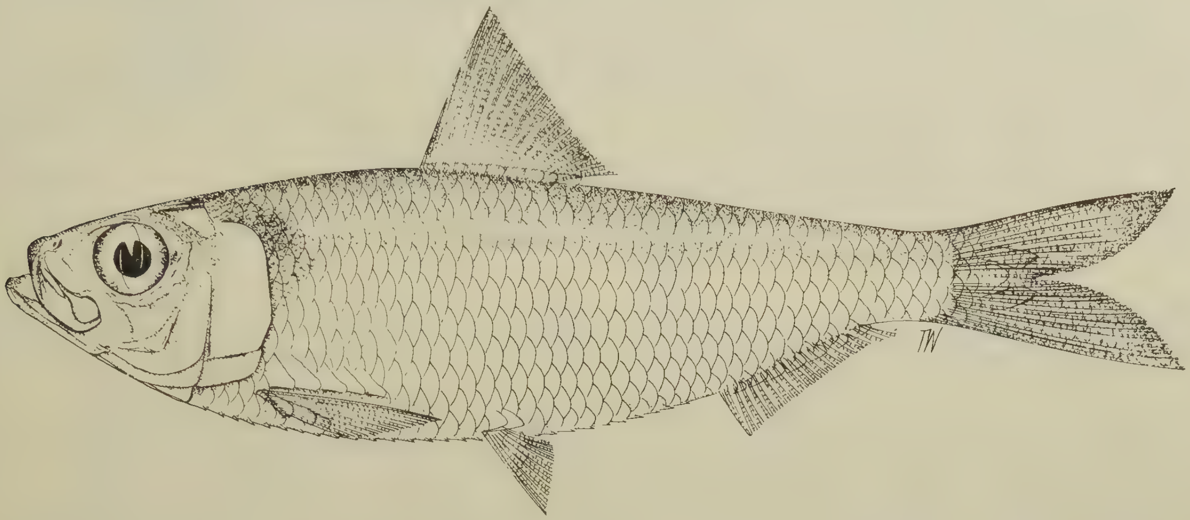
Sardinella tawilis (Herre, 1927)

CLUP Sardl 23

Harengula tawilis Herre, 1927, Philipp.J.Sci., 34:273, 296, pl. 3, figs 1-6 (Lake Bombon, Luzon).

Synonyms : Sardinella tawilis: Wongratana, 1980:126, pls 63, 64 (revision).

FAO Names : En - Freshwater sardinella.



Diagnostic Features : Body fairly slender, its depth 29 to 31% of standard length; total scutes 28 to 30. Lower gillrakers 61 to 74 (at 7 to 10 cm standard length). No dark markings on dorsal or caudal fins. Immediately separated from all other species of Sardinella by its only known locality (Lake Bombon, Luzon, the Philippines).

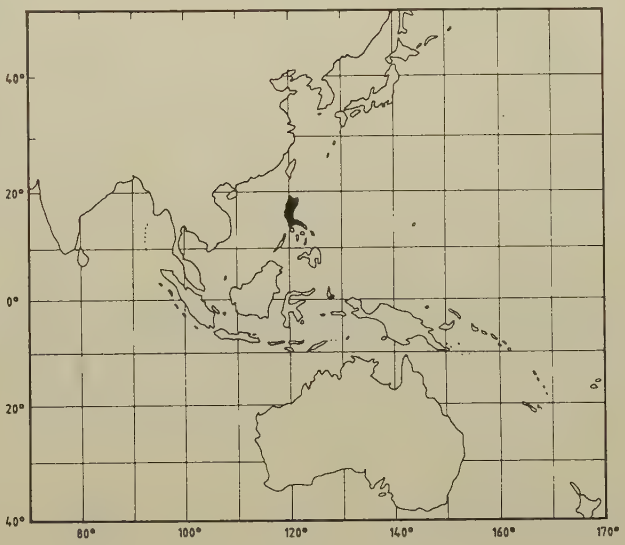
Geographical Distribution : The Philippines (Lake Bombon, Luzon).

Habitat and Biology : Freshwater, presumably schooling. This is the only species of Sardinella that is apparently found only, or even mainly, in freshwater. More data needed.

Size : To 10 cm standard length.

Interest to Fisheries : Of minor local interest.

Local Names : -



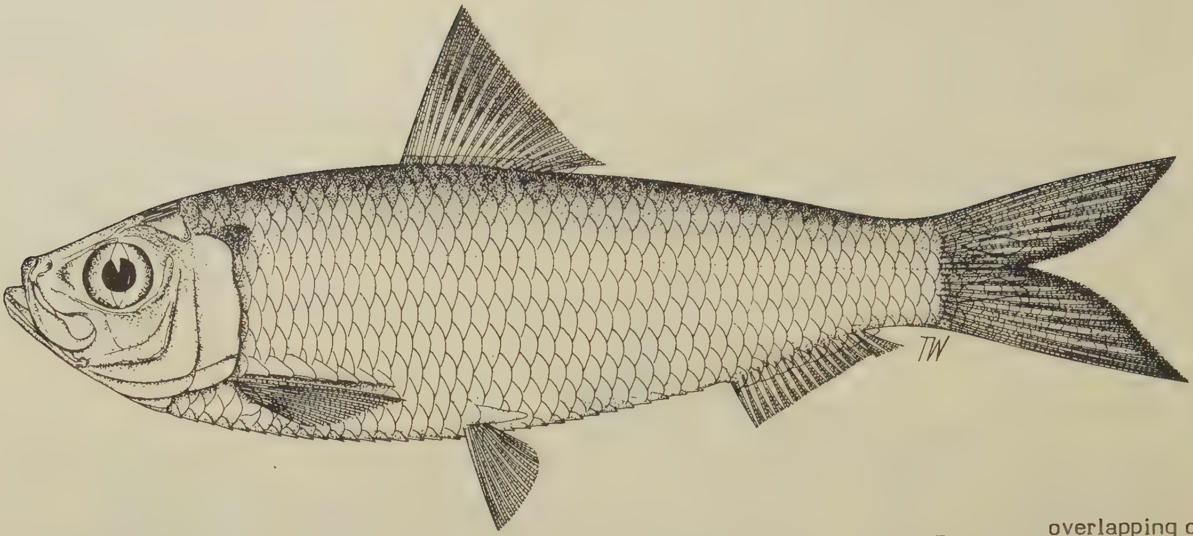
Sardinella zunasi (Bleeker, 1854)

CLUP Sardl 24

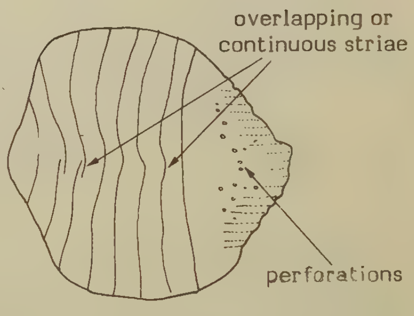
Harengula zunasi (Bleeker, 1854, Natuurk.Tjdschr.Ned.-Indië, 6:417 (Nagasaki).

Synonyms : Harengula zunasi:Fowler, 1941:597 (Japan, the Koreas); Sardinella zunasi:Chan, 1965:21, fig. 10 (Japan); Whitehead, 1973b:179 (in key only); Wongratana, 1980:130, pls 71, 72 (revision).

FAO Names : En - Japanese sardinella.



Diagnostic Features : Body moderately slender, but variable, its depth 24 to 33% of standard length; total scutes 29 to 32 (usually 30 or 31). Lower gillrakers 42 to 58 (usually less than 55 in fishes up to 12 cm standard length). Vertical striae on scales overlapping or continuous, only a few small perforations on hind part of scale. No dark spot at dorsal fin origin. Most closely resembles S. richardsoni, which has more gillrakers (63 to 74) and has a slightly deeper body (32 to 36% of standard length, at least at 10 to 12 cm standard length). Of other species in the area, S. hualiensis also has overlapping or continuous scale striae, but black tips to dorsal and caudal fins; while S. fimbriata and S. albella have the scale striae interrupted at the centre of the scale.



scale

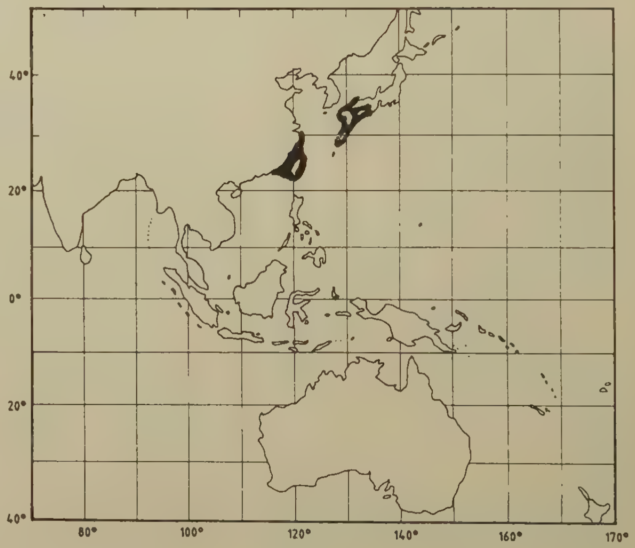
Geographical Distribution : Western Pacific (southern coasts of Japan south to about Taiwan Island; Chan (1965:22) included Hong Kong, but it is suspicuous that he had no specimens from there).

Habitat and Biology : Coastal, pelagic, schooling. More data needed.

Size : To 13 cm standard length, usually to about 10 cm.

Interest to Fisheries : Contributes to local catches of Sardinella. Reported as Harengula zunasi (10 606 tons from the Koreas in 1983, but probably mixed with other species.

Local Names : JAPAN: Zunasi, Zunashi.



Clupea Linnaeus, 1758

CLUP Clup

Clupea Linnaeus, 1758, *Syst.nat.*, 10th ed.:317 (type: *Clupea harengus* Linnaeus). *Rogenia* Valenciennes, 1847, *Hist.nat.poiss.*, 20:340 (type: *Rogenia alba* Yarrell = *C. harengus*).

Diagnostic Features : Moderately slender fishes, with the belly fairly rounded and the scutes not forming a strong keel; mainly characterized by lacking various specialized features of other genera. Operculum smooth and without bony radiating striae (cf. *Sardinops*, which has spots along the flanks). Hind border of gill opening smooth and without a pair of fleshy outgrowths (cf. *Sardinella*). Pelvic finrays i 8 (i 7 in *Sprattus* and *Clupeonella*, which lack a bony capsule (bulla) in the pterotic bone; i 8 in *Alosa*, but a distinct median notch in upper jaw; i 8 in some species of *Sardinella*, but strong fronto-parietal striae on top of head, also gill opening different and last two anal finrays enlarged); pelvic fin insertion behind dorsal fin origin (below or in front in *Sprattus*). No dark spots along flanks, at dorsal fin origin, on gill cover or tips of caudal fin.

Biology, Habitat and Distribution : Marine, pelagic and schooling, down to about 200 m, mainly offshore (but some populations entering or even confined to brackishwater in bays or saline lakes); juveniles in shallow water. Eggs demersal, adhesive on the sea bed or on marine vegetation. Confined to cooler or cold waters of the Northern Hemisphere.

Interest to Fisheries : One of the prime northern genera, with a long history of exploitation and, in recent years, over-exploitation in both Atlantic and Pacific waters. The total catch of *Clupea* in 1983 was 1 418 078 tons (but up to twice that catch in earlier years before imposition of restrictions, e.g. 2 520 800 tons in 1973).

Species : Authors have mostly followed Svetovidov (1952:120, 1963:126), who advocated recognition of two subspecies of *Clupea harengus*, an Atlantic (and Baltic) and a Pacific (and White Sea eastward), the latter with fewer vertebrae. The Atlantic and Pacific herrings, as Svetovidov also noted, have rather different spawning patterns; in addition, the Pacific herring is said to have a thinner egg membrane. No detailed analysis has been made of this problem since Svetovidov's studies. Were it not for the presence of Pacific-type herrings in the White Sea and eastwards, and an overlap with Atlantic-type herrings in the White Sea, it would be much simpler to recognize a distinct Pacific species widely separated geographically from an Atlantic species. However, the White Sea and associated forms apparently remain genetically distinct and could be regarded as a relict from the time when a Pacific species inhabited all the Arctic waters of the Soviet Union. For this reason it is preferred here to follow American authors and to recognize two species:

C. harengus Linnaeus, 1758, North Atlantic to White Sea, Baltic
C. pallasii Valenciennes, 1847, North Pacific, White Sea and eastward.

Remarks : Differences between the two species can be summarized as follows:

(a) *C. harengus*: vertebrae 51 to 60 (usually 55 to 57); spawning throughout year (spring, summer, autumn and winter herrings); spawn usually some distance from shore, at 25 to 200 m; spawn usually at relatively high temperatures (10 to 15°C); spawn at high salinities; egg masses dense, deposited on sea bed.

(b) *C. pallasii*: vertebrae 49 to 57 (usually 52 to 55); spawning in spring (i.e. spring herrings only); spawn in coastal waters, often close to shore, at 0 to 20 m (usually less than 15 m); spawn at relatively low temperatures (0 to 10°C); spawn at low salinities (10 to 21 °/oo optimum) egg masses more sparse, in one or two layers only, deposited on marine vegetation.

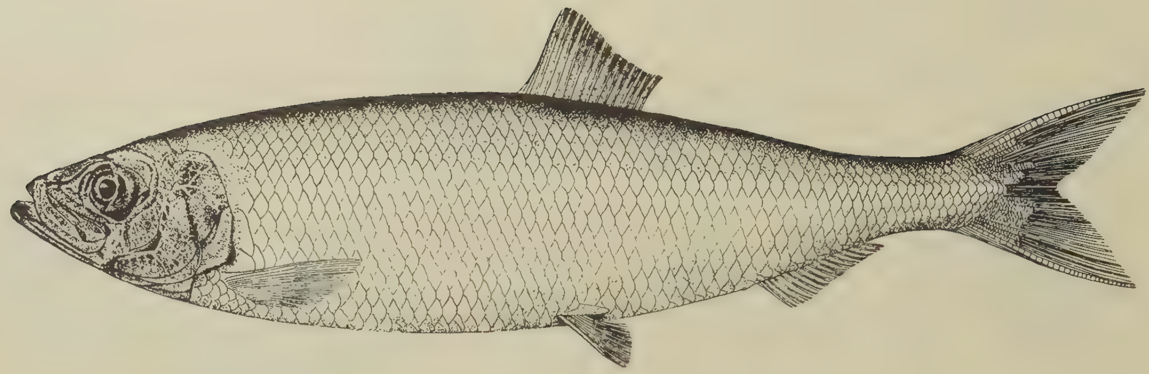
Clupea harengus Linnaeus, 1758

CLUP Clup 1

Clupea harengus Linnaeus, 1758, *Syst.nat.*, 10th ed.:317 (northern Europe).

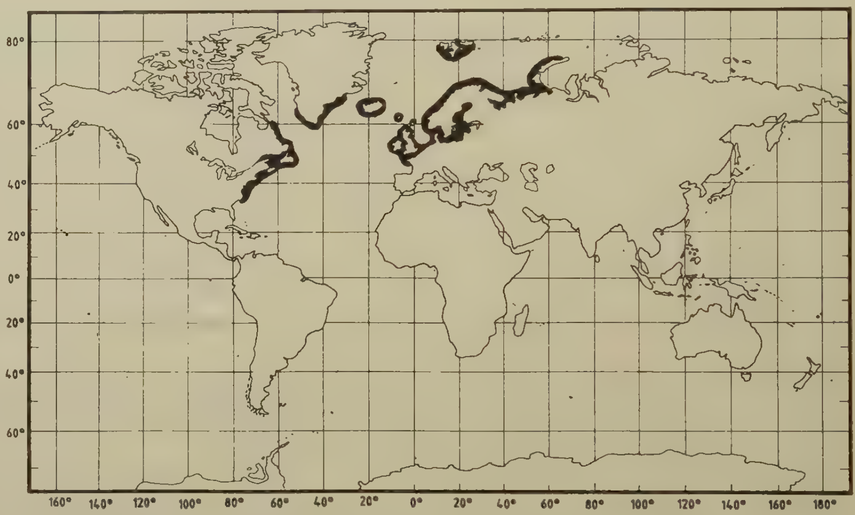
Synonyms : *Clupea harengus* B *membras* Linnaeus, 1761:128 (Baltic); *Cyprinus esca* Walbaum, 1792:36 (on Pennant, 1769); *Clupea elongata* LeSueur, 1818:234 (Massachusetts); *Clupea alba* Yarrell, 1829:137, 465, pl. 5, fig. 2 (Thames estuary); *Clupea leachii* Yarrell, 1832:277, pl. 12 (Thames, Medway estuaries); *Clupea minima* Storer, 1839:113 (New Hampshire); *Clupea harengus* - Svetovidov, 1952:117, pl. 2, figs 1, 2, pl. 3 fig. 2 (eastern Atlantic, Baltic); *Idem*, 1963:123, same plates; FWNA, 1964:275, fig. 66 (western Atlantic); Andriyashev, 1964:73 (northern seas of USSR); Liem & Scott, 1966:94 (western Atlantic); Whitehead, 1967:17 (*Rogenia alba* of Valenciennes); CLOFNAM, 1973:99 (eastern Atlantic, full synonymy); FNAM, 1984:219 (eastern Atlantic, synopsis).

FAO Names : En - Atlantic herring.



Diagnostic Features : Body elongate and fairly slender, belly rather rounded, scutes without prominent keel. No median notch in upper jaw (cf. *Alosa*). Gill cover (operculum) without radiating bony striae (cf. *Sardinops*, which has dark spots along the flank). Hind border of gill opening evenly rounded (with two fleshy outgrowths in *Sardinella*). Pelvic fin insertion behind vertical from dorsal fin origin (below or in front in *Sprattus*); pelvic finrays i 8 (rarely i 7 or i 9) (only *Alosa* and some species of *Sardinella* have this count; all other clupeids have i 6 or i 7). No distinctive dark spots on body or fins. Overlaps *C. pallasii* in White Sea, but distinguished by more vertebrae and post-pelvic scutes (usually 55 to 57 and 12 to 16; cf. usually 52 to 55 and 10 to 14).

Geographical Distribution : Eastern Atlantic (northern Bay of Biscay northward to Iceland and southern Greenland, eastward to Spitzbergen and Novaya Zemlya, also Baltic); western Atlantic (southwestern Greenland, Labrador, southward to South Carolina).



Habitat and Biology : Coastal, pelagic down to 200 m, schooling, with complex feeding and spawning migrations, whose times and extent correlate with the various more or less distinct races which can be recognized on morphological grounds (mainly numbers of vertebrae, finrays, scales and gillrakers). Feeds on small planktonic copepods in the first year, and thereafter mainly copepods (especially *Calanus finmarchicus* and *Temora longicornis*), but also hyperid amphipods, euphausids, mysid shrimps, small fishes, arrow-worms, ctenophores and pteropods). At least one population is spawning in any one month of the year, each race having a different spawning time and place (spring, summer, autumn and winter herrings; in 0 to 5 m off Greenland down to 200 m in autumn (bank) herrings of the North Sea; eggs laid on the sea bed, on rock, stones, gravel, sand or beds of algae or phanerogams (see also data under genus). Note: it is impossible to summarize briefly the wide range of spawning strategies of Atlantic herring; the best reviews are those of Svetovidov (1952, 1963) for the eastern Atlantic and FWNA (1964) for the western Atlantic.

Size : To 40 cm standard length, usually 20 to 25 cm.

Interest to Fisheries : Although stocks have been badly over-fished and depleted in recent years, *Clupea harengus* still ranks as the third most heavily exploited clupeid fish. The total catch in 1983 was 1 141 736 tons, of which 976 041 tons came from the eastern North Atlantic, and 23 253 tons from the western North Atlantic.

Local Names : Numerous local names have been given, not only to the species, but to all the various forms (subspecies, races, etc., of authors).

Literature : More has been published on *Clupea harengus* than on any other fish. This literature is summarized by Svetovidov (1952, 1963) and FWNA (1964), with some additional references in CLOFNAM (1973), a succinct account for Canadian Atlantic coasts by Liem & Scott (1966), and a similar account for the northern seas of the USSR by Andriyashev (1964); many further and more recent papers are given by Blaxter & Hunter (1982). As many as a hundred or more papers appear annually on all aspects of herring biology and fisheries.

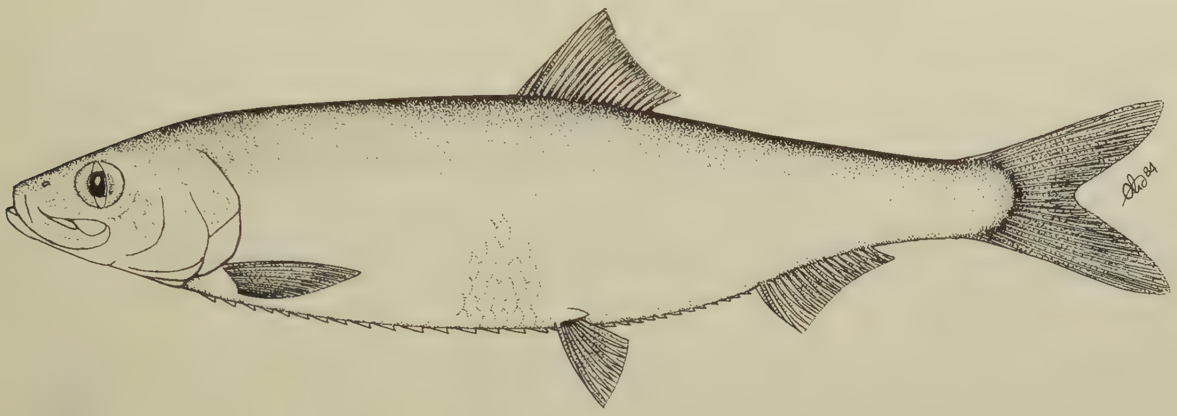
Clupea pallasii Valenciennes, 1847

CLUP Clup 2

Clupea pallasii Valenciennes, 1847, Hist.nat.poiss., 20:253 (Pallas specimen, Kamchatka).

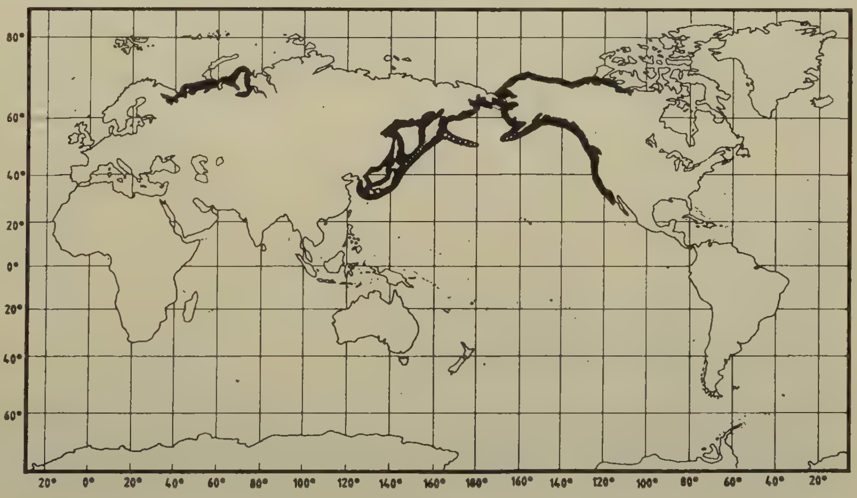
Synonyms : ? Clupea lineolata Valenciennes, 1847:256 (Pallas specimen, no locality); Clupea mirabilis Girard, 1854:138 (San Francisco); Clupea inermis Basilewsky, 1855:242 (China); Spratelloides bryoporus Cope, 1873:25 (Alaska); Clupea harengus pallasi:Svetovidov, 1952:145, pls 3, fig. 2 and 4, figs 1, 2 (western Pacific); Idem, 1963:155, same plates; Andriyashev, 1964:77 (northern seas of USSR); Shmidt, 1965:19 (Sea of Okhotsk); Hart, 1973:96, fig. (Canada, Pacific coasts, synopsis); Clupea pallasii:Clemens & Wilby, 1967:99, fig. 34 (Canada, Pacific coasts; misspelt); Whitehead & Bauchot, in press (pallasii and lineolata types).

FAO Names : En - Pacific herring.



Diagnostic Features : Body elongate and fairly slender, belly rather rounded, scutes without prominent keel. No median notch in upper jaw (cf. the introduced Alosa sapidissima of the eastern Pacific). Gill cover (operculum) without radiating bony striae (cf. Sardinops, which has dark spots along the flank). Pelvic finrays i 8 (as in Sardinella lemuru of southern Japan, which has strong fronto-parietal striae on top of head and a pair of fleshy outgrowths on the hind border of the gill opening). No distinctive dark spots on body or fins. Overlaps C. harengus in White Sea, but distinguished by fewer vertebrae and post-pelvic scutes (usually 52 to 55 and 10 to 14; cf. usually 55 to 57 and 12 to 16).

Geographical Distribution : Arctic Sea (White Sea eastward to Ob inlet); western Pacific (from Anadyr Bay, eastern coasts of Kamchatka, possibly the Aleutian Islands southward to Japan and western coasts of Korea); eastern Pacific (Kent Peninsula at 107°W and Beaufort Sea southward to northern Baja California and San Diego).



Habitat and Biology : Coastal, pelagic, schooling, migrating inshore to breed, but without any strong north-south migrations, the population being localized. Apparently landlocked populations (races) exist in the lakes of South Sakhalin, eastern Hokkaido and eastern Honshu. Feeds on euphausids, also copepods, mysids, amphipods and zoca of crabs. Breeds from December to July, depending on the latitude, coming into shallow water and depositing eggs on marine vegetation (mainly eelgrass and seaweeds) or solid materials (see also data under genus). Spawning fishes will enter estuaries.

Size : To 33 cm, usually to 25 cm standard length.

Interest to Fisheries : Of prime importance on both sides of the Pacific, but stocks depleted by overfishing in recent years. The total catch in 1983 was 276 342 tons, of which 179 721 tons came from the western North Pacific (mainly USSR, China and Japan) and 88 643 tons from the eastern North Pacific (Canada and USA).

Local Names : -

Literature : Summarized for western Pacific by Svetovidov (1952, 1963) and for the Canadian Pacific by Hart (1973 - excellent synopsis of biology and fishery, with over sixty selected references). See also Ye (1980, 1983) and Ye, Tang & Qin (1981) on the Yellow Sea form and its fishery.

Escualosa Whitley, 1940

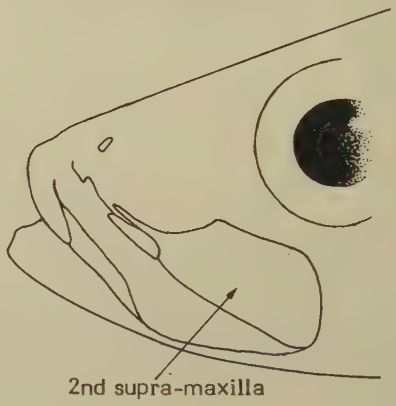
CLUP Esc

Leptogaster Bleeker, 1872, Atlas Ichthyol.Ind.Néerland., **6**: pl. 262, fig. 2 (type: Clupea (Leptogaster) argyrotaenia - nomen oblitum fide Whitehead et al., 1966:70). Kowala (not of Valenciennes):Regan, 1922, Ann.Mag.nat.Hist., (9)**10**:587 (type: Kowala thoracata Valenciennes, designated by Regan, but overlooking earlier designation of K. albella by Gill - see Sardinella synonymy). Escualosa Whitley, 1940, Aust.Zool., **9**(4):402 (type: Clupea macrolepis Steindachner = K. thoracata Valenciennes).

Diagnostic Features : Small clupeid fishes, strongly compressed, the belly keeled. Resembling juvenile Sardinella, Amblygaster and Herklotsichthys, but hind margin of gill opening evenly rounded (cf. with two fleshy outgrowths; also, tip of maxilla and second supra-maxilla enlarged, the latter more or less rectangular. Pelvic finrays i 6. Anal fin short (iii to iv 14 to 18 finrays; cf. iii to iv 31 to 49 in the pristigasterids Ilisha and Pellona). A bright silver stripe along flank.

Biology, Habitat and Distribution : Coastal, pelagic, schooling, mainly shallow waters; juveniles found in lower parts of rivers.

Interest to Fisheries : Contributes to clupeoid catches, especially on the western coast of India.



Species : Following the revision by Wongratana (1981), two species are now recognized:

E. elongata Wongratana, 1983, Gulf of Thailand
E. thoracata (Valenciennes, 1847), northern Indian Ocean, western Pacific.

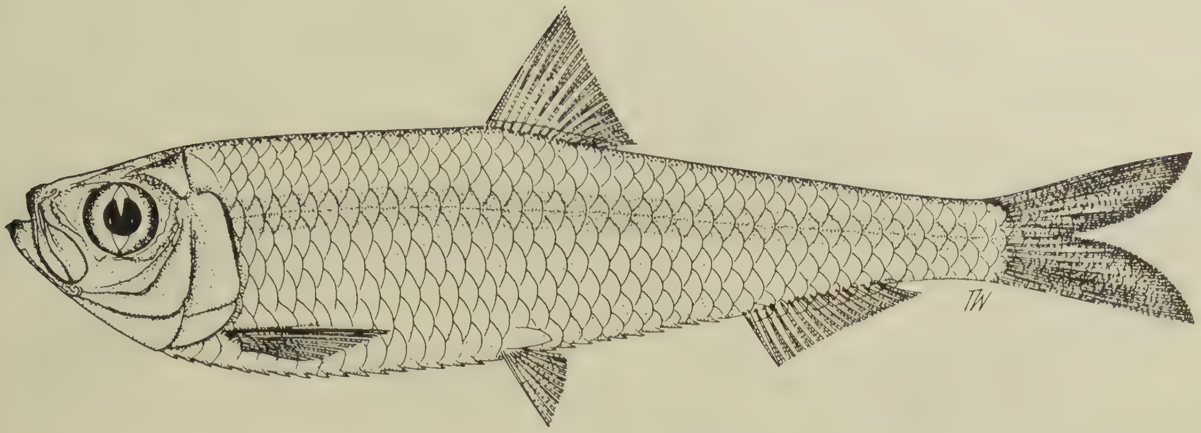
Escualosa elongata Wongratana, 1983

CLUP Esc 2

Escualosa elongata Wongratana, 1983, Jap.J.Ichthyol., **29**(4):392, fig. 8 (east coast of Gulf of Thailand).

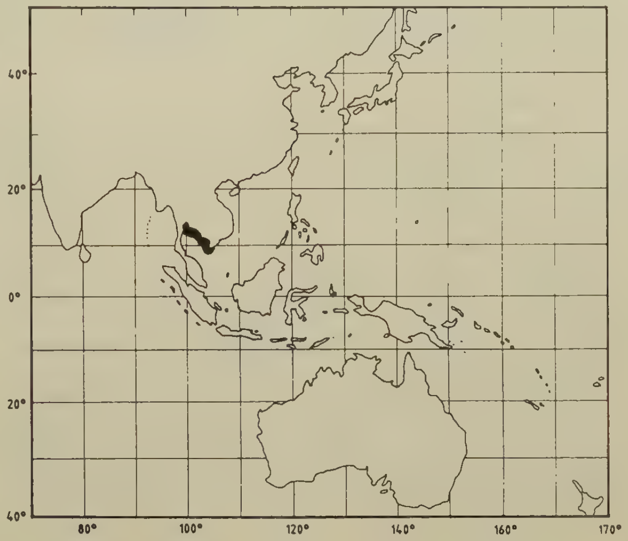
Synonyms : None.

FAO Names : En - Slender white sardine.



Diagnostic Features : Body slender, its depth 25% of standard length, belly strongly keeled. Separated from similar fishes in the area by the characters given under K. thoracata, from which it differs by its more slender body (cf. 27 to 37% of standard length) and narrower silver stripe along the flank (about half eye diameter; cf. about equal to eye diameter).

Geographical Distribution : Known only from 2 specimens from the east coast of the Gulf of Thailand (but discovered at the Sunday Market in Bangkok). More specimens needed.



Habitat and Biology : Presumed marine and coastal pelagic. More data needed.

Size : To 6.7 cm standard length.

Interest to Fisheries : No data, but presumably not abundant.

Local Names : -

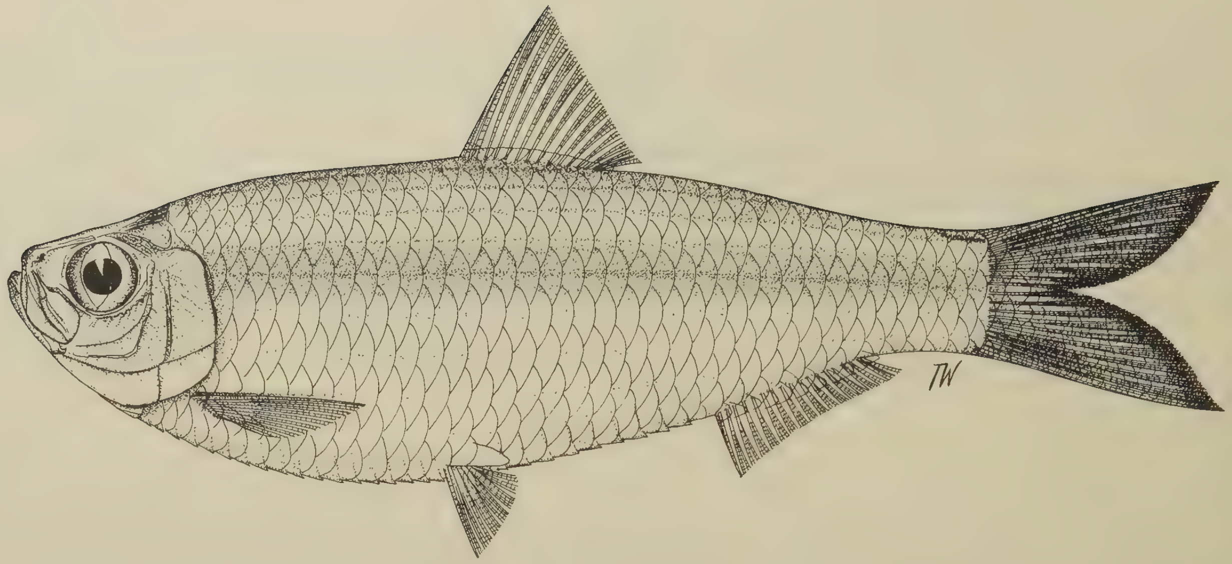
Escualosa thoracata (Valenciennes, 1847)

CLUP Esc 1

Kowala thoracata Valenciennes, 1847, Hist.nat.poiss., **20**:363 (Pondicherry).

Synonyms : ? Clupea coval Cuvier, 1829:318 (footnote; on Kowal of Russel, 1803 - nomen dubium fide Whitehead, 1967:70); Meletta lile Valenciennes, 1847:378 (Pondicherry, Coromandel); Alausa champil (Cantor, 1850:1284 (Penang); Rogenia argijrotaenia Bleeker, 1852:457 (Muntok, Jakarta); Clupea (Leptogaster) argyrotaenia:Bleeker, 1872:pl. 262, fig. 2; Clupea macrolepis Steindachner, 1879:13 (Townsville, Queensland); ? Clupea huae Tirant, 1929:29 (Viet Nam); Kowala coval:Fowler, 1941:638 (Borneo); Escualosa thoracata - Whitehead et alii, 1966:71 (argijrotaenia types); Whitehead, 1967:70, 71, 72 (coval, also thoracata and lile types); Idem, 1973b:189, fig. 20 (Indian Ocean, synopsis); Nair, 1973:74, fig. 18 (India); Wongratana, 1980:154, pls 100, 101 (revision); Whitehead & Bauchot, in press (coval, lile).

FAO Names : En - White sardine.

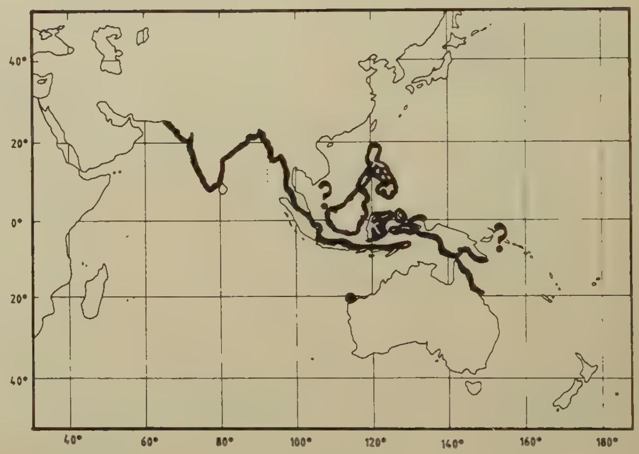


Diagnostic Features : Body fairly deep and compressed, its depth 27 to 30% of standard length, belly strongly keeled. The almost rectangular second supra-maxilla and the bright silver stripe along the flank distinguish it from juveniles of *Sardinella*, *Amblygaster* and *Herklotsichthys* (see also under genus). Resembles some pellonulines with a silver stripe (species of *Clupeoides*, *Clupeichthys*), but they lack a first (anterior) supra-maxilla. Distinguished from *Escualosa elongata* of the Gulf of Thailand by its deeper body (more than 25% of standard length) and broader silver stripe (about equal to eye diameter: cf. about half eye diameter). See CLUP Esc 1, Fishing Area 51.

Geographical Distribution : Northern Indian Ocean (Karachi eastward to Rangoon), Indonesia (Java Sea), the Philippines southward to Papua New Guinea, Australia (Queensland at Townsville and Western Australia at Onslow).

Habitat and Biology : Coastal, pelagic, schooling, in shallow waters, the juveniles apparently entering the lower parts of rivers (e.g. Canning River, eastern coast of India), but returning later to the sea. Feeds on both zooplankton (copepods, crab zoea, larvae of bivalves and fish eggs) and phytoplankton. Breeds from October to February (mainly November to January) off western coast of India, usually in relatively shallow inshore waters. The eggs and larvae are well illustrated by Nair (1973).

Size : To 10 cm standard length, common at 8 cm.



Interest to Fisheries : An important element in clupeoid fisheries off western coasts of India (over 1000 tons in some years *fide* Nair, 1973:table 17). Separate statistics not reported.

Local Names : INDIA: Chooda, Veloori (Malayalam), Swadi balanjil (Kannada), Bhitgi (Marathi).

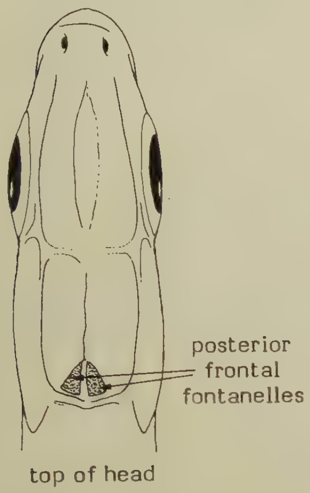
Literature : Nair (1973 - excellent synopsis for India, including illustrations of eggs and larvae).

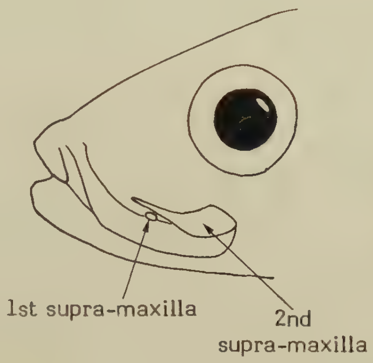
Platanichthys Whitehead, 1968

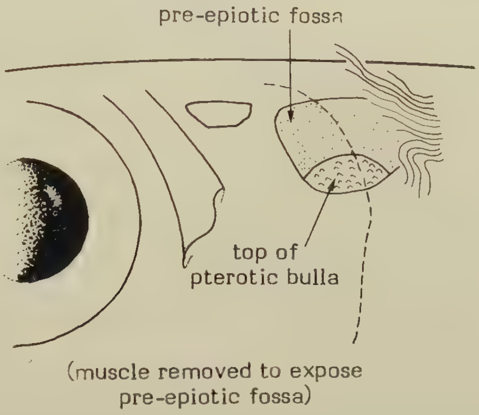
CLUP Plat

Platanichthys Whitehead, 1968, J.nat.Hist., 2:477 (type: Lile platana Regan).

Diagnostic Features : Small clupeid fishes of South American fresh- or brackishwaters, the body strongly compressed and the belly sharply keeled. Posterior frontal fontanelles on top of head retained in adults (occluded in Ramnogaster). Anterior (first) supra-maxilla very small or absent; no sharp backward-pointing (retrorse) spine near front of maxilla (cf. Rhinosardinia). Pelvic finrays i 6 or rarely i 5 (cf. i 7 in Rhinosardinia, Lile, Strangomera). Very closely resembles Sprattus, but a bony capsule (bulla) present in pterotic and a very distinct silver lateral stripe down flank (stripe absent in Sprattus and Ramnogaster).







Biology, Habitat and Distribution : Estuaries and lower parts of rivers, presumably schooling; known only from Argentina, Uruguay and Brazil.

Interest to Fisheries : Probably of little importance.

Species : A single species recognized:

Platanichthys platana (Regan, 1917), western South Atlantic.

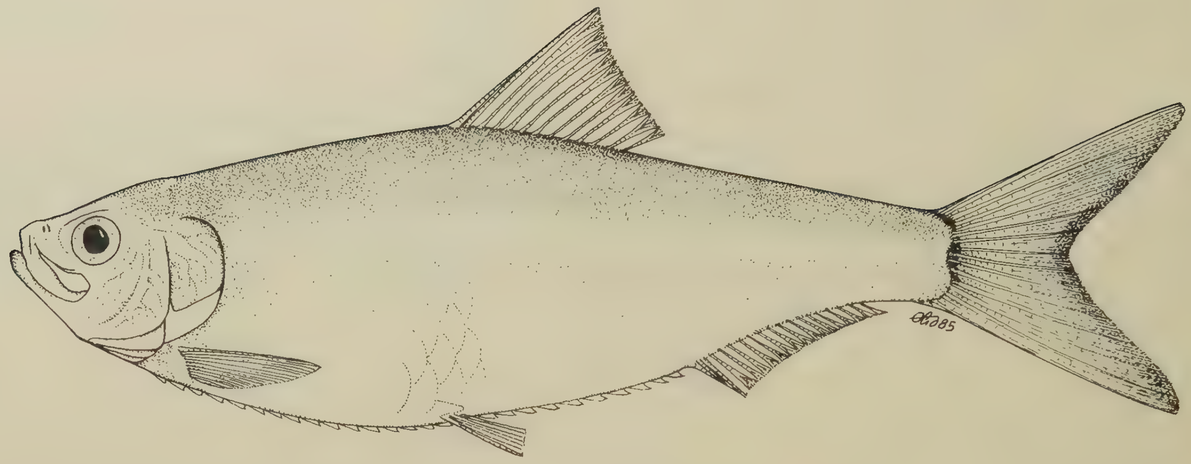
Platanichthys platana (Regan, 1917)

CLUP Plat 1

Lile platana Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:394 (La Plata).

Synonyms : Spratella pallida de Buen, 1952:7 (Nueva Palmira, mouth of Uruguay River); ? Stolephorus otidus Ringuelet, 1942:435 (Laguna Chascomús, Argentina); Clupea melanostoma limnoica Aramburu, 1961:2 (Laguna Chascomús and others, Argentina); Platanichthys platana - Whitehead, 1968:479, fig. 1 (description, relationships); Figueiredo & Menezes, 1978:25, fig. 29 (Brazil).

FAO Names : En - River Plate sprat.



Diagnostic Features : Body moderately deep and strongly compressed, its depth about 30% of standard length, belly sharply keeled. Anterior (first) supra-maxilla minute or absent. Closely resembles species of Ramnogaster, which lack a distinct silver stripe along flank and have a well-developed first supra-maxilla. Distinguished from species of Rhinosardinia by the absence of a sharp backward-pointing (retrorse) spine near front of maxilla and only i 5 or 6 pelvic finrays (i 7 in Rhinosardinia); from Sprattus fuegensis by the pelvic count (cf. i 7) and presence of silver lateral stripe; and from small Sardinella and Harengula by the absence of two fleshy outgrowths on the hind margin of the gill opening.

Geographical Distribution : Western South Atlantic (lagoons, estuaries, lower parts of rivers of Argentina (Rio de la Plata), Uruguay (Uruguay River), northward to just north of Rio de Janeiro, Brazil).

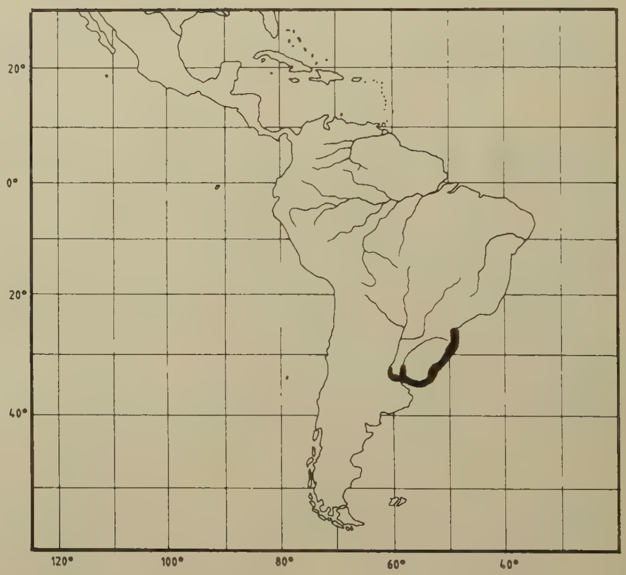
Habitat and Biology : Probably confined to fresh- and brackishwaters of lagoons, estuaries and the lower reaches of rivers. More data needed.

Size : To 6.7 cm standard length, usually around 5 cm.

Interest to Fisheries : Perhaps makes a small contribution locally.

Local Names : -

Literature : De Buen (1952 - Uruguay, as Spratella pallida); Whitehead (1964 - description).



Ramnogaster Whitehead, 1964

Ramnogaster Whitehead, 1964, Ann.Mag.nat.Hist., (13)7:324 (type: Clupea arcuata Jenyns).

Diagnostic Features: Small clupeid fishes of South American freshwaters, the body strongly compressed and the belly sharply keeled. Posterior frontal fontanelles on top of head reduced in size and finally occluded in fishes of 7 or 8 cm standard length (retained in Platanichthys, see page 121). No sharp backward-pointing (retrorse) spine near front of maxilla (cf. Rhinosardinia). Pelvic finrays i 6 (cf. i 7 in Rhinosardinia, Lile, Strangomera). Very closely resembles Sprattus, which lacks a bony capsule (bulla) in the pterotic bone. Flanks silvery, without a bright silver stripe (cf. Platanichthys).

Biology, Habitat and Distribution: Littoral areas, estuaries and rivers from Uruguay to Patagonia.

Interest to Fisheries: Probably of little importance.

Species: De Buen (1952) recognized three species, with some overlap in proportional and meristic characters. One of these (R. pallida) is probably Platanichthys platana, but the other two seem distinct:

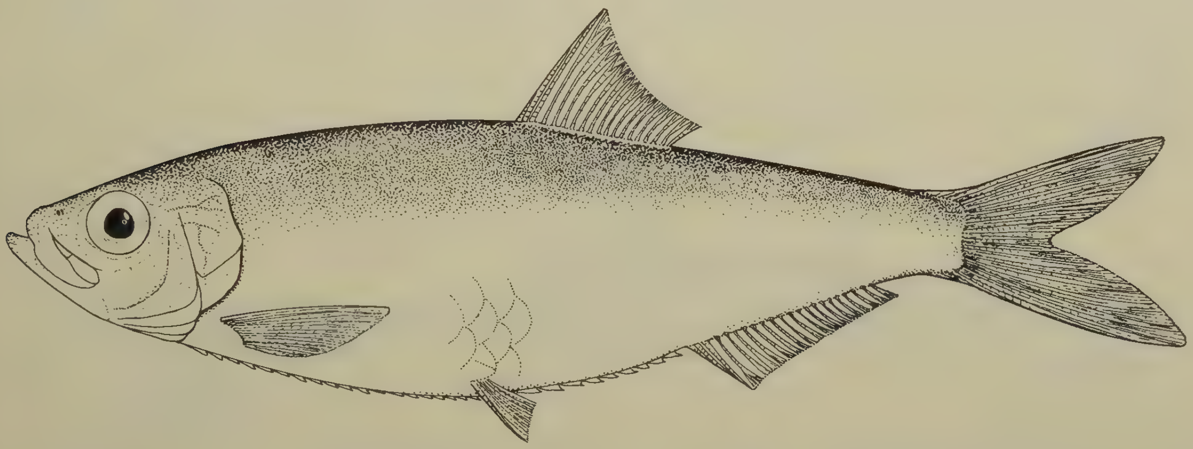
Ramnogaster arcuata (Jenyns, 1842), western South Atlantic
Ramnogaster melanostoma (Eigenmann, 1907), western South Atlantic.

Ramnogaster arcuata (Jenyns, 1842)

Clupea arcuata Jenyns, 1842, Zool.voy.Beagle, fishes:134 (Bahia Blanca, Argentina).

Synonyms: Clupea arcuata Regan, 1917:228 (Bahia Blanca, Montevideo); Norman, 1937:39, fig. 16; Fowler, 1945:2, fig. (all Chile refs); Ringuelet, Arámburu & Arámburu, 1967:56 (Mar del Plata, good synonymy); Spratella arcuata:de Buen, 1952:5 (La Paloma, Uruguay); Ramnogaster arcuata - Whitehead, 1964:324 (type, review).

FAO Names: En - Jenyns's sprat.



Diagnostic Features: Body moderately deep and compressed, its depth about 30% of standard length, belly sharply keeled. Distinguished from the very similar R. melanostoma of freshwaters by having more dorsal finrays (18 or 19; cf. 15 or 16), more pectoral finrays (16; cf. 13 or 14) and more gillrakers (total 41 to 45; cf. 36 to 38). Resembles Platanichthys platana, which has a distinct silver stripe along the flank, and the first (anterior) supramaxilla minute or absent; separated from small Sardinella and Harengula by the evenly rounded hind margin of the gill opening (cf. with two fleshy outgrowths), and from Sprattus fuegensis by having i 6 pelvic finrays (cf. i 7).

Geographical Distribution : Western South Atlantic (coasts of South America, from Uruguay and southern Brazil (estuary of the Lagoa dos Patos) southward to at least Bahía Blanca, Argentina; some of the more southerly records (even to the Beagle Channel) must refer to Sprattus fuegensis.

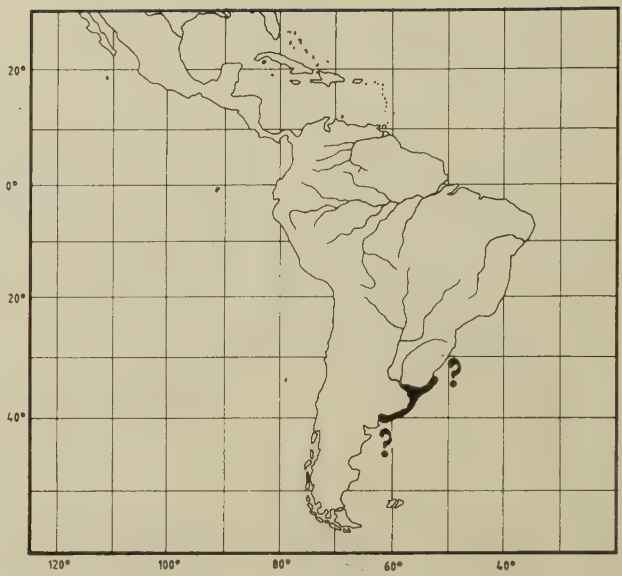
Habitat and Biology : Coastal, pelagic, schooling, apparently inshore but not entering freshwater. More data needed.

Size : To 9 cm standard length, usually about 7 to 8 cm.

Interest to Fisheries : Perhaps of local importance.

Local Names : -

Literature : De Buen (1952 - review).



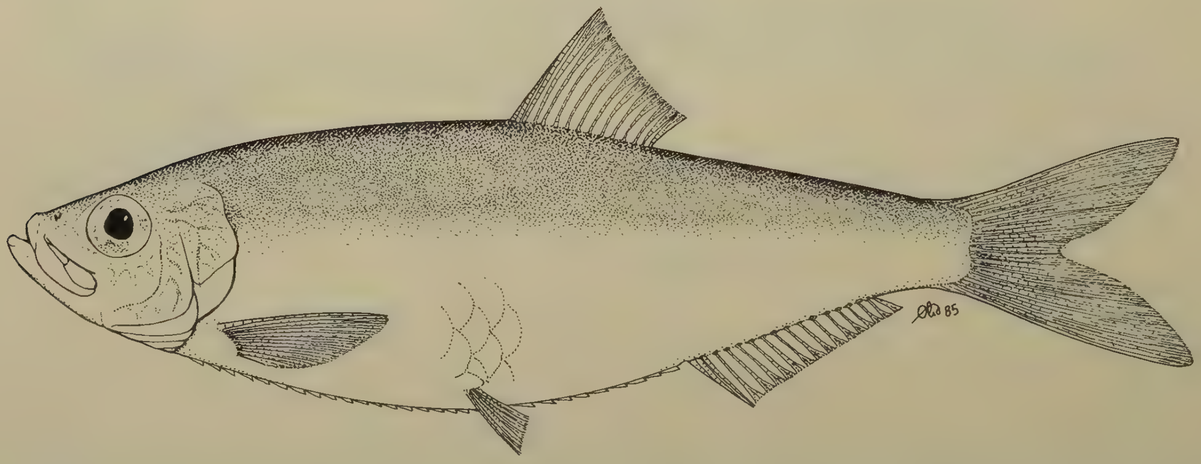
Ramnogaster melanostoma (Eigenmann, 1907)

CLUP Ramno 2

Pomolobus ? melanostomus Eigenmann, 1907, Proc.Wash.Acad.Sci., **8**:452, pl. 23, fig. 6 (Buenos Aires).

Synonyms : Clupea melanostoma:Regan, 1917:229 (Rio de la Plata); Norman, 1937:39 (same); Ringuelet, Arámburu & Arámburu, 1967:58 (Río de la Plata, Paraná delta, good synonymy); Clupea melanostoma limnoica Arámburu, 1961:2, pl. 1 (Buenos Aires); Ringuelet et al., 1967:59, fig. 1 B (same); Spratella melanostoma:de Buen, 1952:6 (Nueva Palmira, mouth of Uruguay River); Ramnogaster melanostoma - Whitehead, 1964:326 (mention).

FAO Names : En - Uruguay river sprat.



Diagnostic Features : Body moderately deep and compressed, its depth about 30% of standard length, belly sharply keeled. Distinguished from the very similar R. arcuata of coastal waters by having fewer dorsal finrays (15 or 16; cf. 18 or 19), fewer pectoral finrays (13 or 14; cf. 16) and fewer gillrakers (total 36 to 38; cf. 41 to 45). Resembles the fresh and brackish water Platanichthys platana, which has a distinct silver stripe along the flank and the first (anterior) supra-maxilla minute or absent. Separated from small Sardinella and Harengula by the evenly rounded hind margin of the gill opening (cf. with two fleshy outgrowths).

Geographical Distribution : Western South Atlantic (Uruguay, Argentina, in estuary and lower reaches of Rio de la Plata and associated rivers, e.g. Paraná and Uruguay rivers).

Habitat and Biology : Apparently confined to freshwater at mouths of rivers and their lower reaches, presumably schooling. More data needed.

Size : To 10 cm standard length.

Interest to Fisheries : Perhaps makes a small contribution locally.

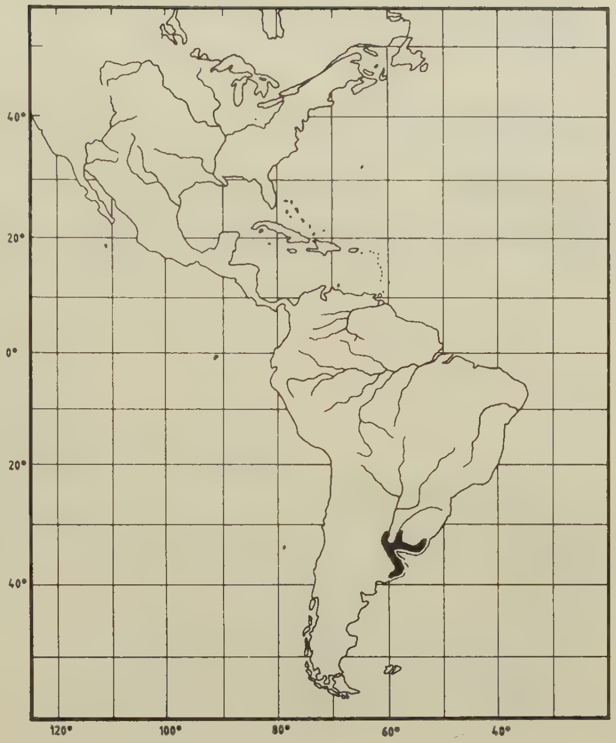
Local Names : ARGENTINA: Mandufia.

Literature : See under Synonyms.

Remarks : According to Ringuelet, Arámburu & Arámburu (1967), two subspecies can be recognized:

(a) R. melanostoma melanostoma: body slender, its depth 27 to 31% of standard length; dorsal finrays 16 or 17; Río de la Plata and middle and lower reaches of Río Paraná and Río Uruguay.

(b) R. melanostoma limnoica: body deep, its depth 33 to 41% of standard length; dorsal finrays 13 or 14; brackish lagoons around Buenos Aires.

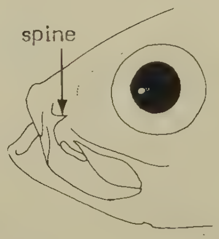


Rhinosardinia Eigenmann, 1912

CLUP Rhino

Heringia Fowler, 1911, Proc.Acad.nat.Sci.Philad., **63**:207 (type: Clupea amazonica Steindachner; name preoccupied in Diptera). Rhinosardinia Eigenmann, 1912, Mem.Carnegie Mus., **5**:445 (type: Rhinosardinia serrata Eigenmann = R. amazonica).

Diagnostic Features : Small freshwater clupeids of South America, the body fairly strongly compressed and the belly sharply keeled. A sharp backward-pointing (retrorse) spine on upper part of maxilla at about level of eye centre. This retrorse spine is unknown in any other clupeid fish and thus immediately distinguishes the genus. Anterior (first) supra-maxilla normal (minute or absent in Platanichthys. Hind border of gill opening evenly rounded (with two fleshy outgrowths in Sardinella and Harengula). Anal fin short (about 15 to 18 finrays; cf. 30 or more in the pristigasterids Pellona, Ilisha, etc.). Flanks with or without a distinct silver stripe.



Biology, Habitat and Distribution : Fresh- and brackishwaters, perhaps to quite high salinities, presumably schooling; from the Orinoco south to Salvador, Brazil.

Interest to Fisheries : Probably of little importance.

Species : Three species are given in FWNA (1964:411, key), but Eigenmann's R. serrata is undoubtedly R. amazonica. The status of R. bahiensis is probably secure, but its distinction relies almost wholly on its higher vertebral and scale counts (based on rather few specimens); the presence of a silver lateral stripe in R. bahiensis but not R. amazonica, used in the key of FWNA and by Whitehead (1973a:53), is doubtful (see under species):

R. amazonica (Steindachner, 1879), western South and central Atlantic.
R. bahiensis (Steindachner, 1879), western South and central Atlantic.

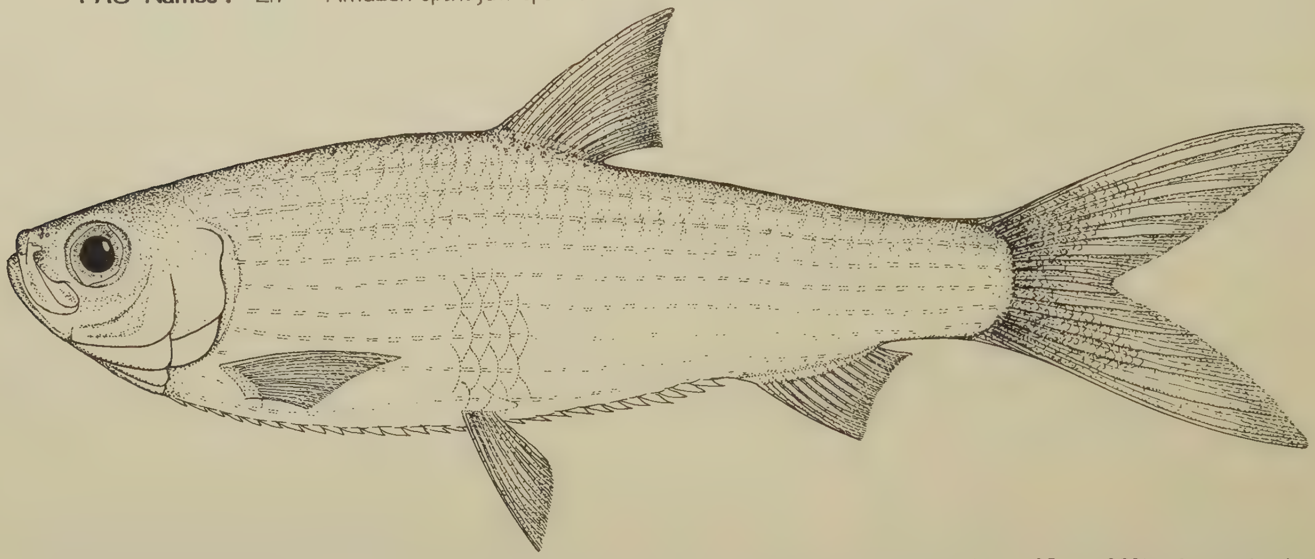
Rhinosardinia amazonica (Steindachner, 1879)

CLUP Rhino 1

Clupea amazonica Steindachner, 1879, *Sber.Akad.Wiss.Wien*, **80**:183 (Amazon at Pará); *Idem*, 1880, *Ichthyol.Beitr.*, (8):65 (repeat).

Synonyms : *Heringia amazonica*:Fowler, 1911:207 (Surinam); Regan, 1917:394 (Guyana); *Rhinosardinia serrata* Eigenmann, 1912:445, fig. 39 (maxilla), pl. 62, figs 3,4 (Guyana); FWNA, 1964:413, figs 102, 103 (maxilla); *Rhinosardinia amazonica* - FWNA, 1964:412 (compiled); Whitehead 1970:12 (types of *C. amazonica*; *R. serrata* a synonym); *Idem*, 1973a:53, fig. 15 (Guyanas); Cervigón, 1982:212, fig. 1A (maxilla) (Orinoco).

FAO Names : En - Amazon spinejaw sprat.



Diagnostic Features : Body moderately slender, but compressed, its depth about 25 to 28% of standard length, belly strongly keeled. Distinguished from the very similar *R. bahiensis* mainly by having fewer vertebrae (38 or 39; cf. 43 in *R. bahiensis*) and fewer scales in lateral series (39 to 41; cf. 45); other characters apparently overlap. Easily separated from all other clupeids in the area by the sharp backward-pointing (retrorse) spine on the upper part of the maxilla at about the level of the eye centre (see under genus). A silver stripe along flank in some specimens *fide* Cervigón (1983:213). Two distinct parallel striae on scales.

Geographical Distribution : Western central and South Atlantic (lower reaches of the Orinoco, rivers of the Guianas, Amazon at Pará, but undoubtedly elsewhere in its lower part).

Habitat and Biology : Freshwaters of rivers, but also tolerating brackishwater, presumably schooling. Feeds on zooplankton. More data needed.

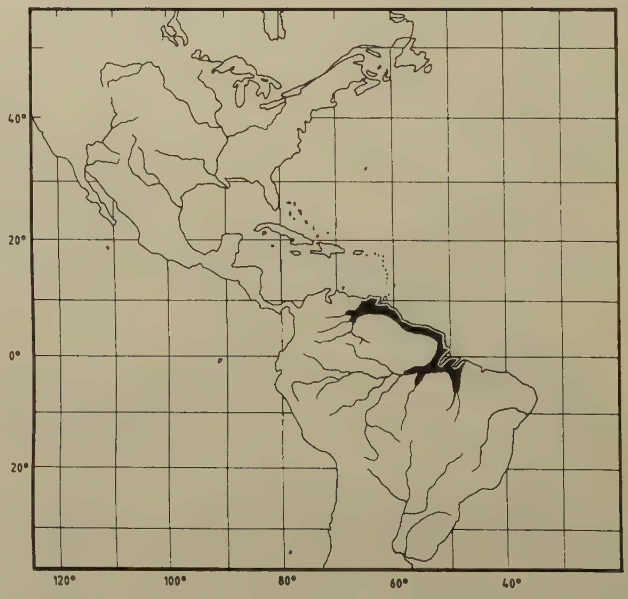
Size : To 8 cm standard length, usually around 5 cm.

Interest to Fisheries : Probably of little importance.

Local Names : -

Literature : Cervigón (1983 - Orinoco material, some notes on biology).

Remarks : Cervigón (1983:213) noted an increase in gillrakers with size of fish in his 17 Orinoco specimens, but not in all cases. Much more material should be studied before the species can be properly diagnosed and its distribution confirmed.



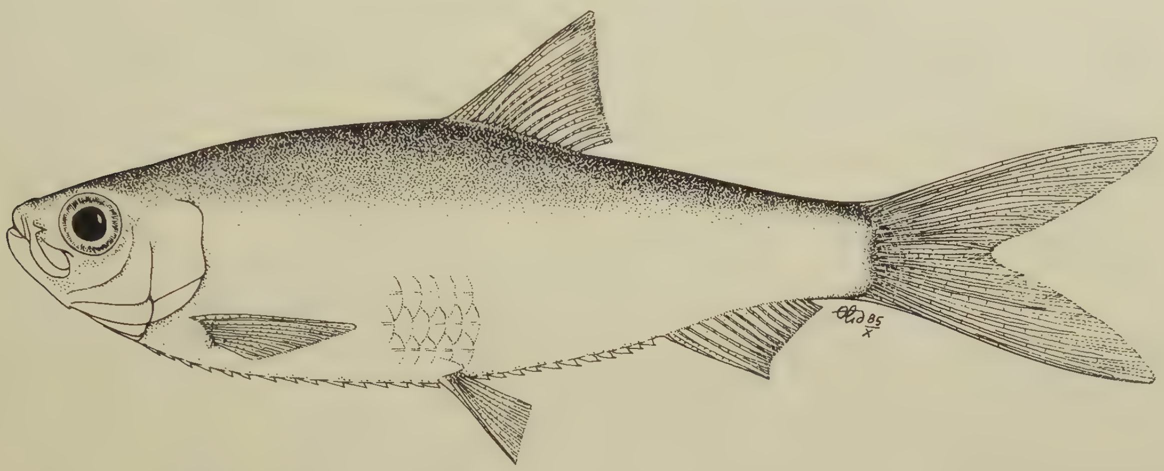
Rhinosardinia bahiensis (Steindachner, 1879)

CLUP Rhino 2

Pellonula bahiensis Steindachner, 1879, Sber.Akad.Wiss.Wien, **80**:181, pl. 3, fig. 2 (Bahia, Brazil); Idem, 1880, Ichthyol.Beitr., (8):63, pl. 3, fig. 2 (repeat). Note: the figure seems based in part on Lile piquitinga.

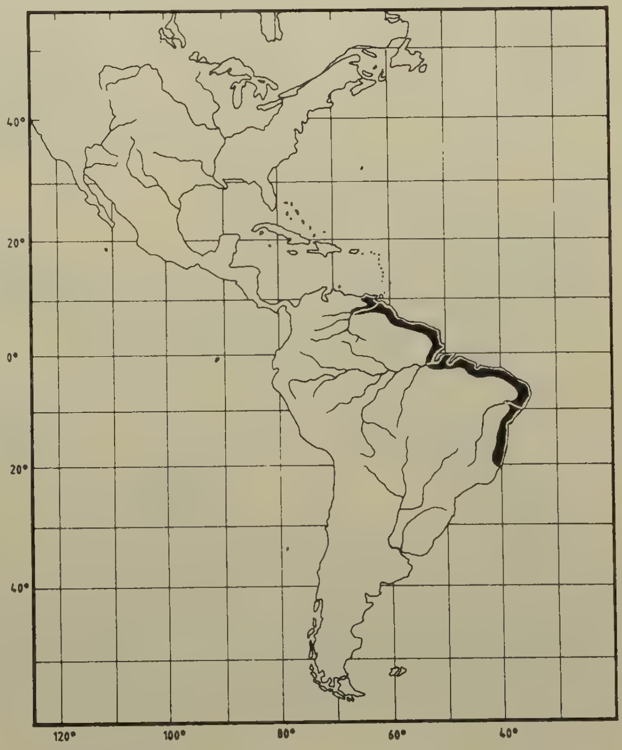
Synonyms : Sardinella pernambucana Schreiner & Ribeiro, 1903:72 (Pernambuco); Heringia bahiensis: Regan, 1917:395 (compiled); FWNA 1964:411 (key only); Whitehead, 1970:14 (type of P. bahiensis - but the chosen lectotype and paralectotype are Lile piquitinga, not Rhinosardinia); Cervigón, 1983:213, fig. 1B (maxilla) (Orinoco); Whitehead & Nelson, 1984:65 (identity of lectotype reported, new lectotype proposed).

FAO Names : En - Bahia sprat.



Diagnostic Features : Body moderately slender, but compressed, its depth about 25% of standard length, belly strongly keeled. Distinguished from the very similar R. amazonica mainly by having more vertebrae (43; cf. 38 or 39 in R. amazonica) and more scales in lateral series (45; cf. 39 to 41); other characters apparently overlap. Easily separated from all other clupeids in the area by the sharp backward-pointing (retrorse) spine on the upper part of the maxilla at about the level of the eye centre (see under genus). The silver stripe along the flank, reported in FWNA (1964:411) and by Whitehead (1970, 1973a), may merely have resulted from inclusion of Lile piquitinga in Steindachner's type material and his figure of the species. Two distinct parallel striae on scales.

Geographical Distribution : Western central and South Atlantic (lower reaches of Orinoco fide Cervigón, 1983; Surinam fide Nelson, in litt.; Pernambuco, Brazil - Schreiner & Ribeiro's S. pernambucana; Bahia, Brazil -the types).



Habitat and Biology : Freshwaters of rivers, but probably also tolerating brackishwater. More data needed.

Size : To 8 cm standard length, perhaps more.

Interest to Fisheries : Probably of little importance.

Local Names : -

Literature : Cervigón (1983 - Orinoco, single specimen).

Remarks : The high vertebral count is surprising in view of the apparent overlap of almost all other characters; unfortunately, only the types and Venezuelan and Surinam specimens have been counted, so that many records of the species are unconfirmed and its real distribution is not certain.

Lile Jordan & Evermann, 1896

CLUP Lile

Lile Jordan & Eigenmann, 1896, *Bull.U.S.natn.Mus.*, **47**(1):428, 429 (type: *Clupea stolifera* Jordan & Gilbert).

Diagnostic Features : Small marine fishes of central and South America, the body elongate to moderately deep, compressed, belly strongly keeled. No backward-pointing (retrorse) spine on upper part of maxilla (cf. *Rhinosardinia*); a well-developed first (anterior) supra-maxilla (cf. minute or absent in *Platanichthys*). Hind border of gill opening evenly rounded (with two fleshy outgrowths in *Sardinella*, *Harengula* and *Opisthonema*). Pelvic finrays i 6 (as in *Rhinosardinia*, but i 7 or i 8 in all other clupeid genera in this area). A very distinct silver stripe along flank.

Biology, Habitat and Distribution : Coastal, pelagic, schooling, probably entering somewhat brackish-waters; western South and central Atlantic, eastern central Pacific.

Interest to Fisheries : Probably of local interest, perhaps more as a baitfish than for food.

Species : The presence of a distinct Atlantic and Pacific species does not appear to have been questioned, although the two are extremely similar. Regan's *Lile platana* is *Platanichthys*. There are thus two species recognized:

L. piquitinga (Schreiner & Ribeiro, 1903), western South and central Atlantic
L. stolifera (Jordan & Gilbert, 1881), eastern central Pacific.

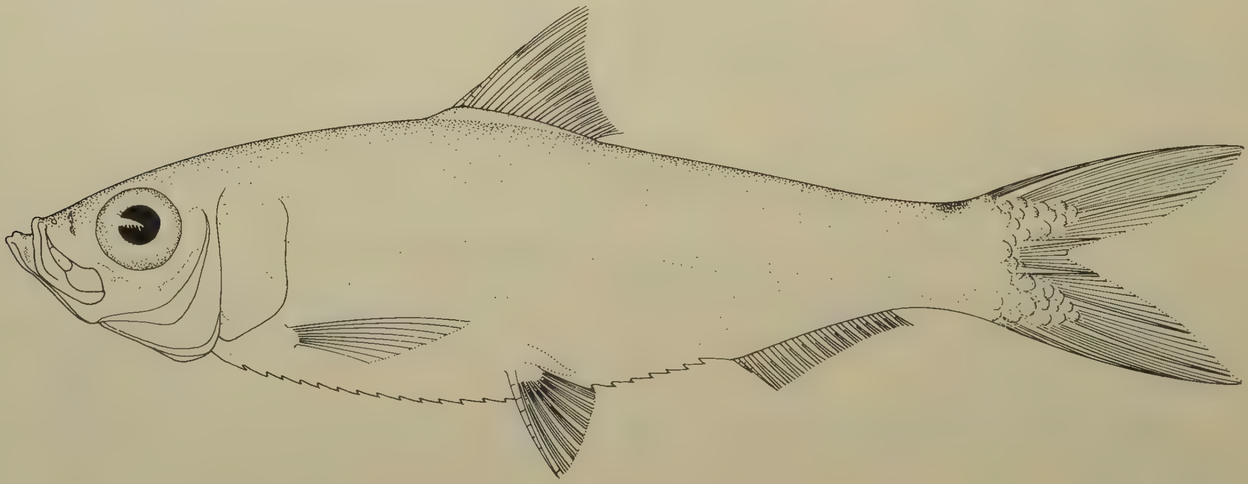
Lile piquitinga (Schreiner & Ribeiro, 1903)

CLUP Lile 1

Sardinella piquitinga Schreiner & Ribeiro, 1903, *Archos Mus.nac.Rio de J.*, **12**:72 (Salvador, Brazil).

Synonyms : Piquitinga of Marcgraf, 1648:159, figure (Recife); *Clupea argentata* Swainson, 1839:386 (Pernambuco - *nomen oblitum*); *Sardinella sardina*:Starks, 1913:8 (L. Papary, near Natal, Brazil); *Lile piquitinga* - Regan, 1917:393 (Pernambuco); Cervigón, 1966:132, fig. 56 (Venezuela); Whitehead, 1973a:48, fig. 13 (Pernambuco, key, Swainson's *C. argentata* discussed, also Marcgraf's *Piquitinga*); Gaspar, 1976:4 (Fig.), 5 (osteology).

FAO Names : En - Atlantic piquitinga.



Diagnostic Features : Body fairly slender, quite strongly compressed, belly sharply keeled. The very bright silver stripe along the flank distinguishes it from all similar clupeids in the area except *Platanichthys platana*, which has i 6 pelvic finrays (cf. i 7 in *Lile*) and first supra-maxilla minute or absent; and *Rhinosardinia* species (sharp backward-pointing spine on upper part of maxilla on a level with centre of eye). Closely resembles the Pacific *L. stolifera*, but caudal fin tips not black. See CLUP Lile 1, Area 31.

Geographical Distribution : Western central Atlantic (Nueva Esparta, Venezuela), western South Atlantic (coasts of Brazil from Recife and Lake Papary near Natal south to Bahia and Espirito Santo); possibly it also occurs between Venezuela and Brazil.

Habitat and Biology : Coastal, pelagic, schooling, inshore and beaches; probably entering somewhat brackishwater (estuaries, lagoons and mangrove swamps). More data needed.

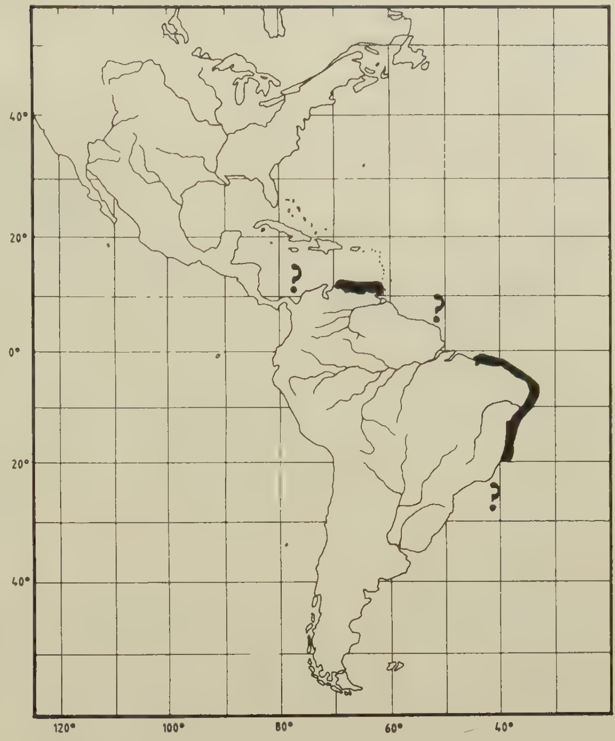
Size : To 15 cm standard length, common around 12 cm.

Interest to Fisheries : Perhaps makes a small local contribution to clupeoid catches.

Local Names : BRAZIL: Piquitinga, Pitim pitinga.

Literature : Whitehead (1973a - nomenclature, historical aspects).

Remarks : It was the search for the original illustration of Marcgrave's Piquitinga that led to the rediscovery of the holograph score of Mozart's 'Cosí fan tutte' and other musical treasures lost since the war (Whitehead, 1982a).



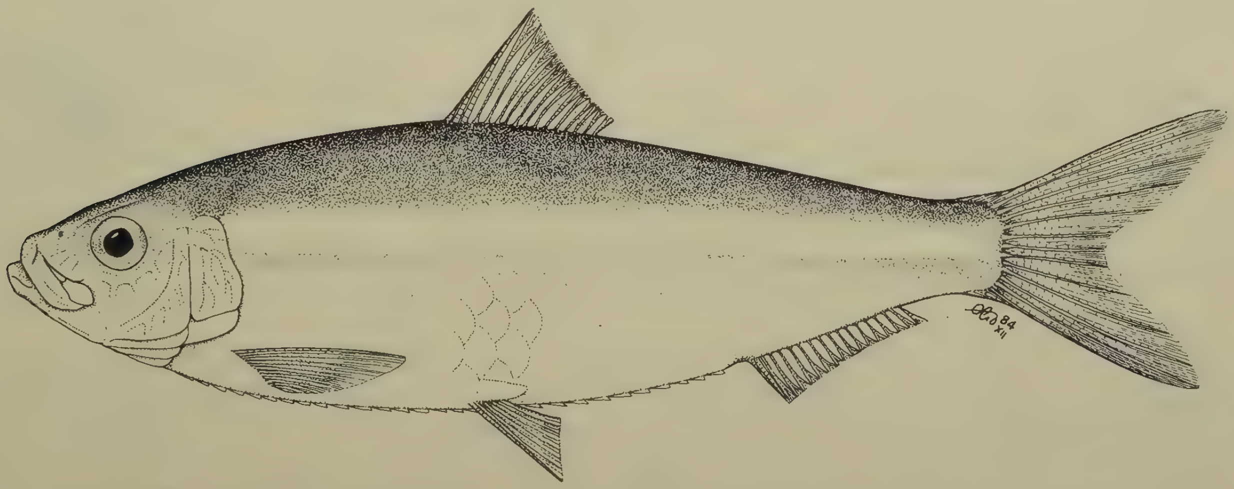
Lile stolifera (Jordan & Gilbert, 1881)

CLUP Lile 2

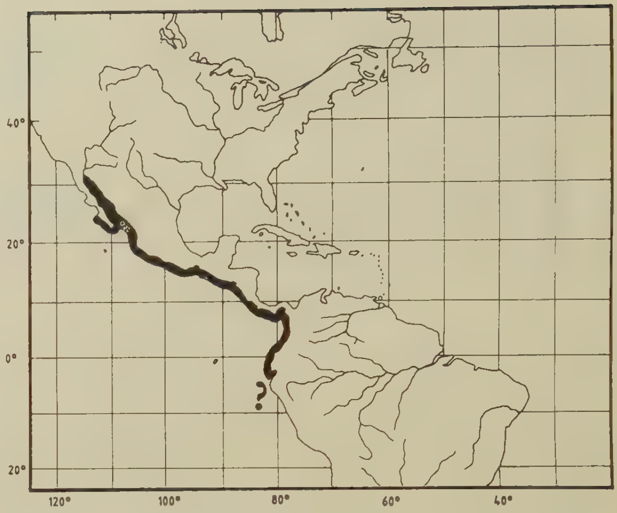
Clupea stolifera Jordan & Gilbert, 1881, Proc.U.S.natn.Mus., **4**:339 (Mazatlan, Mexico).

Synonyms : Sardinella stolifera:Jordan & Everman, 1896:431; Gilbert & Starks, 1904:39 (Panama Bay); Meek & Hildebrand, 1923:182 (Panama); Harengula stolifera:Evermann & Radcliffe, 1917:21 (Capón, Peru); Lile stolifera - Regan, 1917:393 (Mexico); Hildebrand, 1946:90 (Gulf of Guayaquil, Peru); Peterson, 1956:176 (Gulf of Nicoya, Costa Rica); Chirichigno, 1963:13, fig. 5 (Pta Pizzaro, Pta Rico, Peru).

FAO Names : En - Pacific piquitinga.



Diagnostic Features : Body moderately slender, quite strongly compressed, belly sharply keeled. The bright silverstripe along the flank distinguishes it from all similar clupeids in the area. Hind border of gill opening evenly rounded (with two fleshy outgrowths in Harengula and Opisthonema, the latter with a filamentous last dorsal finray).



Geographical Distribution : Eastern central Pacific (Gulf of California southward to Gulf of Guayaquil, Peru).

Habitat and Biology : Coastal pelagic, schooling, inshore and beaches; possibly enters somewhat brackishwaters like its Atlantic counterpart.

Size : To 13 cm standard length, usually around 10 cm.

Interest to Fisheries : Perhaps makes a small local contribution to clupeoid catches.

Local Names : PERU: Pelada.

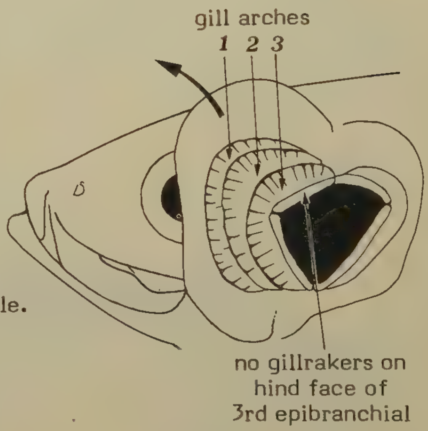
Literature : Meek & Hildebrand (1923 - Panama); Hildebrand (1946 - Peru).

Strangomera Whitehead, 1964

CLUP Strang

Strangomera Whitehead, 1964, Ann.Mag.nat.Hist., (13)7:323 (type: Clupea bentincki Norman).

Diagnostic Features : Closely resembling the Northern Hemisphere herrings (Clupea), but more lower gillrakers (65 to 95; cf. 40 to 51), gillrakers absent on posterior (inner) face of third epibranchial (upper part of third arch, and epibranchial (upper arch) gillrakers of first arch curled upward. Pelvic finrays i 7 (cf. i 6 in Ramnogaster, Platanichthys; i 8 in New World Sardinella). The high gillraker count distinguishes it from Sprattus. No dark spots on flank (cf. Sardinops, which also has bony radiating striae on the gill cover).



Biology, Habitat and Distribution : Coastal, pelagic, schooling; eastern South Pacific.

Interest to Fisheries : Apparently supports a moderate fishery in Chile.

Species : A single species, usually placed in Clupea in the literature:

S. bentincki (Norman, 1936), eastern South Pacific.

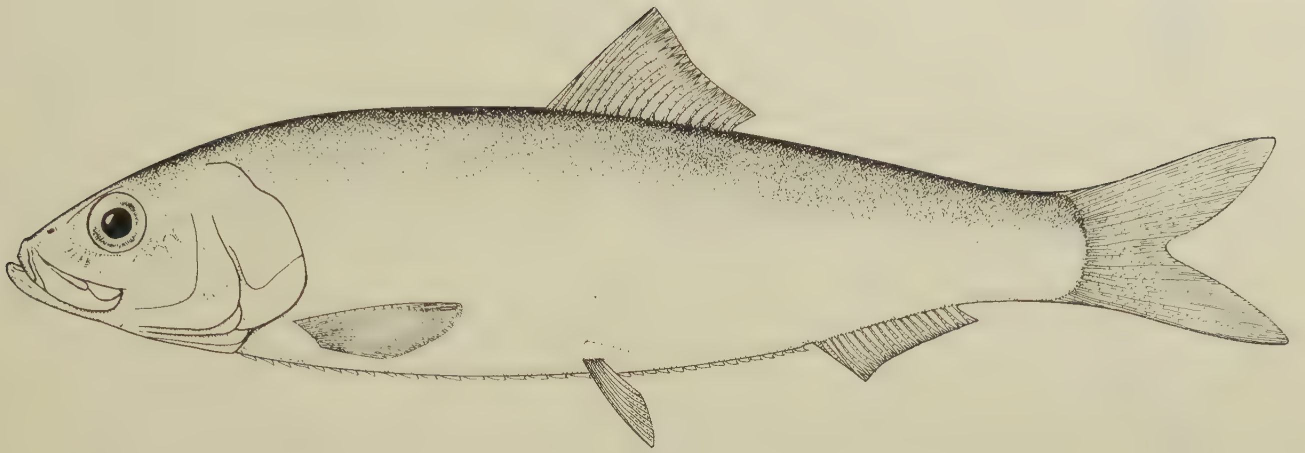
Strangomera bentincki (Norman, 1936)

CLUP Strang 1

Clupea bentincki Norman, 1936, Ann.Mag.nat.Hist., (10)**17**:491 (Talcahuano, Chile).

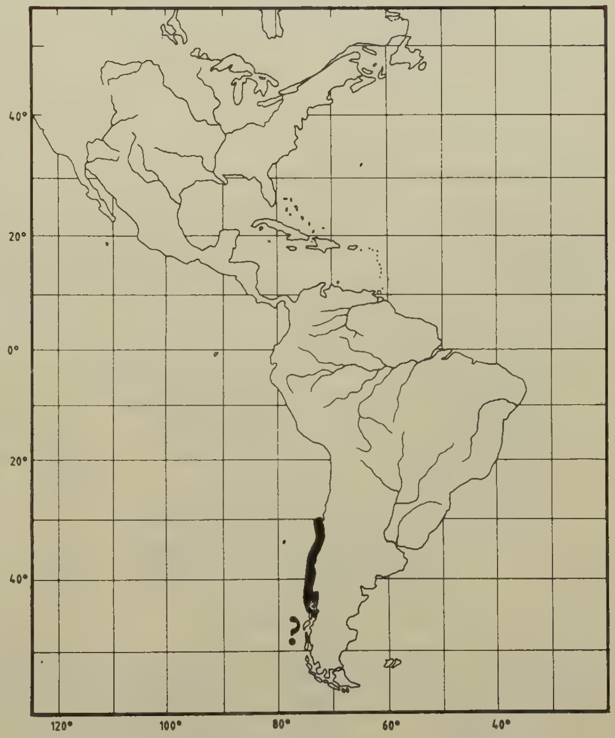
Synonyms : Clupea bentincki:Norman, 1937:38, fig. 15 (Talcahuano, Chile); Fowler, 1945:2 (ref. only); Clupea (Antu) bentincki:De Buen, 1958:89, fig. 1 (subspecies cuga, Valparaíso); Clupea bentincki:Leible & Alveal, 1982:14, fig. 1 (synopsis); Clupea (Strangomera) bentincki:Whitehead, 1964:323 (distinction from species of Clupea, key); Boré & Martinez, 1981:unpaged, colour photo (synopsis).

FAO Names : En - Chilean herring.



Diagnostic Features : Body slender, rather rounded in cross-section, belly not strongly keeled. Resembles *Sardinops sagax*, but no series of dark spots along flank and gill cover smooth (cf. bony radiating striae in *Sardinops*); also resembles *Sprattus fuegensis*, but many more and finer lower gillrakers (65 to 95; cf. less than 50).

Geographical Distribution : Eastern South Pacific (Coquimbo at 29°31'S, Valparaiso and south to Talcahuano, Chile; perhaps reaches further south to Mocha Island, but more southerly records may refer to *Sprattus fuegensis*).



Habitat and Biology : Coastal, pelagic, schooling at or near surface, occurring at 0 to 70 m. Feeds on plankton, especially diatoms (filter-feeding). Breeds mainly June-November, from about 10 cm; apparently releases planktonic eggs (cf. the demersal eggs of Northern Hemisphere *Clupea*). More data needed.

Size : To about 15 cm standard length.

Interest to Fisheries : A significant fishery off Chile between Valparaiso and Talcahuano, mainly at Coquimbo and Talcahuano (35 000 tons in 1981 *fide* Leible & Alveal, 1982). In 1983 a total of 18 557 tons was recorded (Chile only). Around 80% of the catch is used for fishmeal.

Local Names : CHILE: Sardina común; Sardina, Sardina anchoa, Sardina da invierno (Talcahuano).

Literature : Leible & Alveal (1982 - synopsis); Boré & Marlines (1981 - synopsis).

Remarks : De Buen (1958:89) recognized a northern and a southern subspecies:

S. bentincki bentincki: lower gillrakers 75 to 95; eye 25 to 28.6% of head length; Talcahuano and southward.

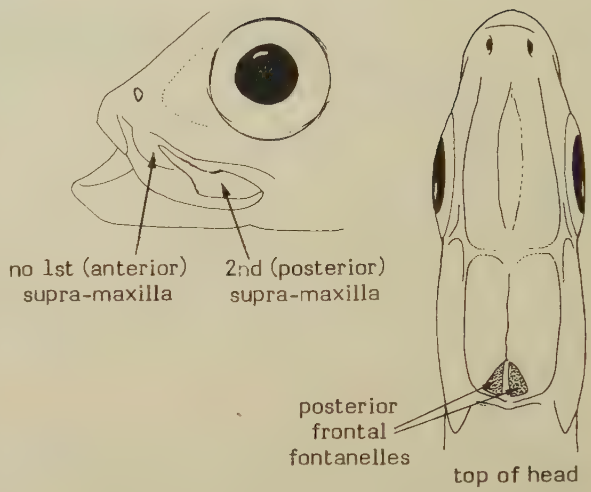
S. bentincki cuga: lower gillrakers 65 to 75; eye 21.7 to 26.1% of head length; Valparaiso to Talcahuano.

The anatomical differences from the Northern Hemisphere *Clupea* and the probability that this fish does not lay demersal adhesive eggs seem to show that it is not more closely related to *Clupea* than to some other clupeid genus; however, its actual relationships have yet to be determined.

2.2.3 SUBFAMILY PELLONULINAE

FAO Names : En - Freshwater herrings, double-armoured herrings.

Diagnostic Features : Small or very small herring-like fishes (usually about 5 to 10 cm standard length, but some larger species to 20 cm and some pygmy species mature at only 1.8 to 2 cm standard length); pelvic scute normal (i.e. with ascending arms), but pre- and post-pelvic scutes reduced or absent in certain genera; scutes present before dorsal fin in the Australian Potamothrissa and Hyperlophus. Anterior supra-maxilla absent; posterior supra-maxilla reduced or absent in some genera; mouth terminal, lower jaw projecting in some genera, teeth usually small and conical, but caniniform in both jaws in Cynothrissa and Odaxothrissa. Posterior frontal fontanelles (on top of head behind level of eyes) remain open in adults. Dorsal fin at about midpoint of body, short (12 to 18 finrays); anal fin short (16 to 27 finrays), its origin well behind last dorsal finray; pelvic finrays usually i 7 (but i 6 in some genera); branchiostegal rays usually 6 or 7 (but 2 to 4 in some genera). Scales present in most, but highly reduced in some genera.


no 1st (anterior) supra-maxilla
2nd (posterior) supra-maxilla
posterior frontal fontanelles
top of head

Biology, Habitat and Distribution : The Pellonulinae are mostly freshwater fishes of tropical or subtropical rivers and lakes, but some enter brackishwater or school in the fully saline waters of bays and inlets. Those of West Africa show varying degrees of reduction of scutes, scales, branchiostegal rays, the posterior second supra-maxilla, and also size; species such as Sierrathrissa leonensis mature at a size where other species are still larvae or small juveniles, and the term progenetic can be applied to them. Pellonulines occur in western and southern Africa, off Indian coasts, in southeast Asia and in Australia; they are absent from the New World.

Interest to Fisheries : A few species contribute significantly to fisheries (e.g. Limnothrissa and Stolothrissa in Lake Tanganika).

Remarks : There are 23 genera (13 West Africa, 3 southern Africa, 5 India and the Indo-Australian Archipelago, and 2 Australia) and about 44 species, the biggest concentration of species being in West Africa (about 26). Future work will probably separate the 'double-armoured' Australian genera (Potamothrissa, Hyperlophus) as yet another subfamily and the West African may be similarly separated from the rest.

Key to the Genera :

1a. Africa and Madagascar, freshwater

   2a. West and central African rivers, lakes

      3a. Pre-pelvic scutes easily visible and keeled, even if only weakly so anteriorly (Fig. 1)

         4a. Pre-maxillae with strong canine teeth within or set behind normal series of small teeth; lower jaw teeth enlarged or canine-like; adults to 13 cm standard length or more (Fig. 2)

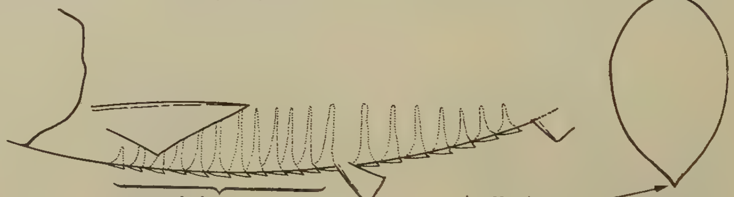
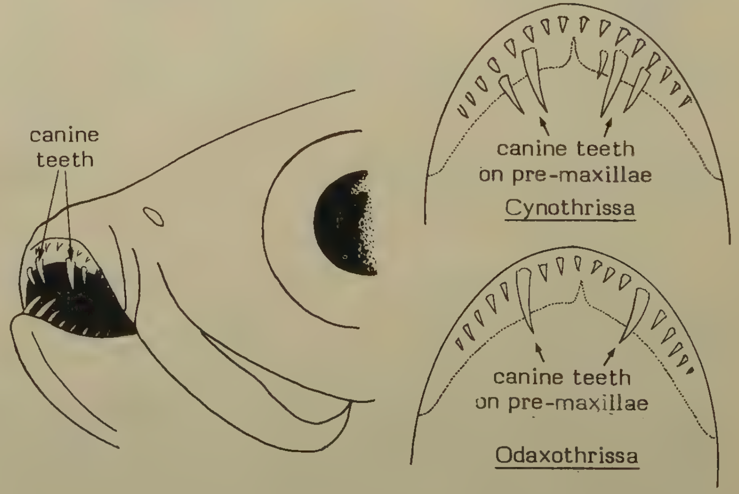


Fig. 1



(upper jaw seen from below)

Fig. 2

5a. Pre-maxillae with 2 to 4 large backward-pointing canines on each side behind normal outer series of smaller teeth; scutes begin before base of first pectoral finray .... **Cynothrissa**

5b. Pre-maxillae with one (or 2) canines about halfway along normal outer series, curved and pointing back; scutes begin behind base of last pectoral finray .... **Odaxothrissa**

4b. Pre-maxillae without canine teeth (sometimes enlarged, but not fang-like); small fishes, rarely exceed 12 cm standard length, usually 5 to 7 cm

6a. Maxilla blade deep (depth 3 or less in length), upper edge of maxilla not flared outward; blade of second supra-maxilla diamond-shaped (Fig. 3a)

7a. Pre-maxillae toothed; pelvic with i 7 finrays, its insertion under or behind dorsal fin origin; adults 5 to 12 cm standard length .... **Pellonula**

7b. Pre-maxillae toothless; pelvic with i 6 finrays, its insertion under or before dorsal fin origin; adults to 4 cm standard length .... **Nannothrissa**

6b. Blade of maxilla long and slender (depth 3 or more times in length), upper edge with ridge flared outward; blade of second supra-maxilla often small, spatulate (Fig. 3b)

8a. Blade of maxilla normal, only a little longer than its shaft; lower gillrakers 14 to 24; Ghana and Zaire system.

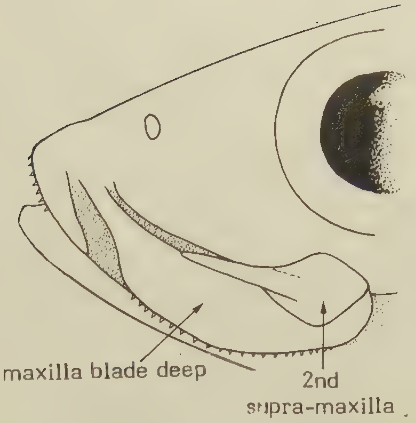
9a. Lower jaw normal, rising steeply within mouth, teeth at front only (Fig. 4a)

10a. Body slender (depth 20 to 24% of standard length); scales large, 27 to 34 in lateral series .... **Poecilothrissa**

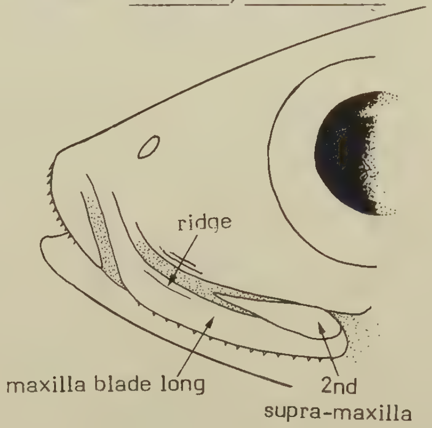
10b. Body deep (depth 22 to 37% of standard length); scales small, 36 to 42 in lateral series .... **Microthrissa**

9b. Lower jaw not rising steeply within mouth, teeth continued at side of jaw (Fig. 4b) .... **Potamothrissa**

8b. Blade of maxilla very long, at least twice the length of its shaft; lower gillrakers 22 to 26 (Lake Mweru) or 31 to 42 (Lake Tanganyika)

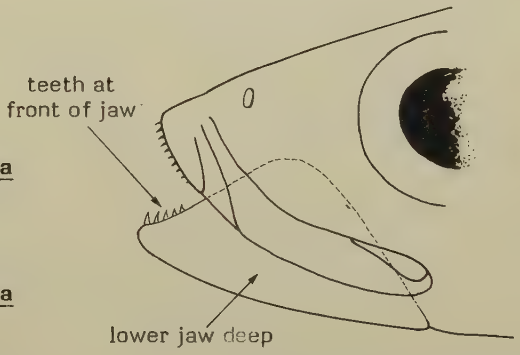


a. Pellonula, Nannothrissa

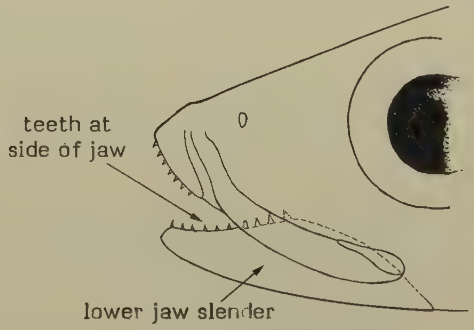


b. Poecilothrissa, etc.

Fig. 3



a. Poecilothrissa, Microthrissa



b. Potamothrissa

Fig. 4

11a. Maxilla blade normal, toothed lower edge not extending foward to tip of pre-maxilla (Fig. 5a) .... **Stolothrissa**

11b. Maxilla blade long, its toothed lower edge reaching to tip of pre-maxilla (Fig. 5b) .... **Limnothrissa**

3b. Pre-pelvic scutes either absent, or without keels, or without lateral arms, and difficult to see; belly rounded (Fig. 6)

12a. Pre-pelvic scutes present (minute or hidden by scales)

13a. Lower gillrakers 10 to 16; anal fin origin below dorsal fin base; dwarf fishes, adult at about 2 cm standard length

14a. Second supra-maxilla present; gillrakers 13 to 16; pre-pelvic scutes without arms........................... **Sierrathrissa**

14b. No second supra-maxilla; gillrakers 10 to 11; pre-pelvic scutes with arms.... **Thrattidion**

13b. Lower gillrakers 21 to 26; anal fin origin behind dorsal fin base; adult at about 3 cm standard length .... **Laeviscutella**

12b. No pre-pelvic or post-pelvic scutes; no second supra-maxilla; lower gillrakers 10 to 12; adult at about 3 cm............. **Congothrissa**

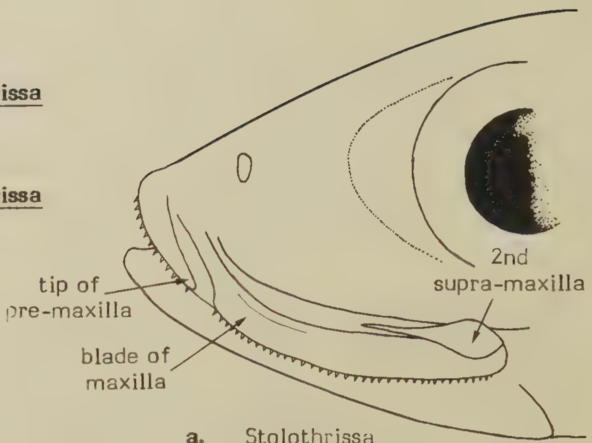
2b. South Africa, Madagascar

15a. Pre-pelvic scutes 6 to 9 (often obscured by scales); South Africa............................. **Gilchristella**

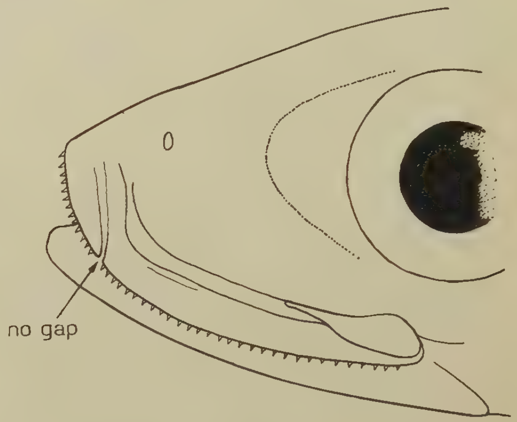
15b. No pre-pelvic scutes; Madagascar

16a. Anal fin entire, last two finrays not separate .... **Sauvagella**

16b. Last two anal finrays separated from rest of fin (Fig. 7) .... **Spratellomorpha**


2nd
supra-maxilla
tip of
pre-maxilla
blade of
maxilla

a. Stolothrissa



b. Limnothrissa Fig. 5

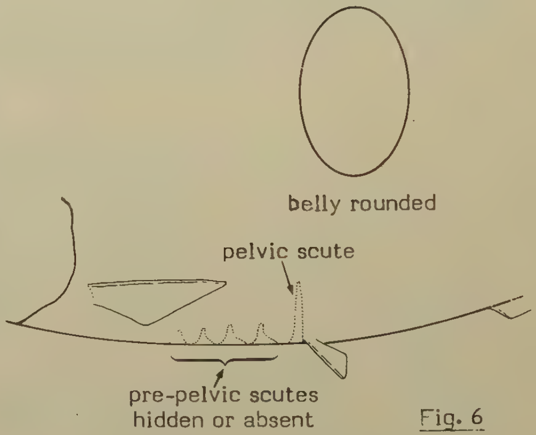
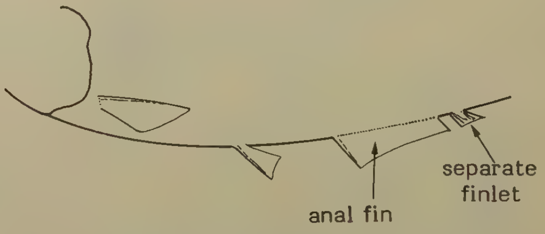

belly rounded
pelvic scute
pre-pelvic scutes
hidden or absent

Fig. 6


separate
finlet
anal fin

Spratellomorpha Fig. 7

1b. Indo-West Pacific (southern Indian Ocean, southeast Asia, Australia)

17a. No scutes in midline before dorsal fin

18a. Belly rounded, no post-pelvic scutes; lower gillrakers 24 to 30; southern India

19a. Pre-pelvic scutes 5 to 8; pelvic fin base just before dorsal fin origin; second supra-maxilla small, half length of maxilla blade (Fig. 8a) ... **Ehirava**

19b. Pre-pelvic scutes 1 to 4; pelvic fin base just behind dorsal fin origin; second supra-maxilla at least half length of maxilla blade (Fig. 8b).... **Dayella**

18b. Belly keeled, scutes present before and behind pelvic fin base; lower gillrakers 12 to 27; southeast Asia, northern Australia, Papua New Guinea

20a. Anal fin entire, last two finrays not separate; lower gillrakers 12 to 24...................................... **Clupeoides**

20b. Last two anal finrays separated from rest of fin (Fig. 7)

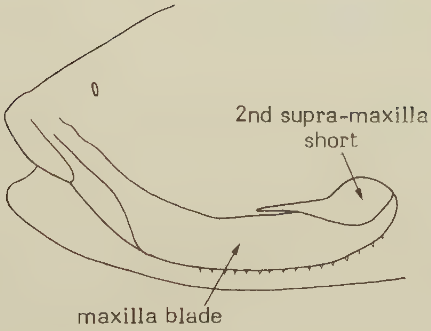
21a. Teeth in jaws small or minute, absent at sides of lower jaw; lower gillrakers 19 to 27................................ **Corica**

21b. Teeth in jaws enlarged, especially in lower jaw and on pre-maxillae, present on sides of lower jaw (Fig. 9); lower gillrakers 13 to 19................................ **Clupeichthys**

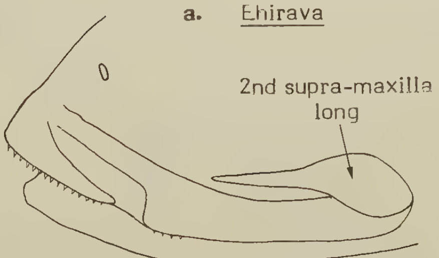
17b. A series of pre-dorsal scutes present (Fig. 10); Australia only

22a. Pelvic finrays i 7; second supra-maxilla not as deep as maxilla blade; 8 branchiostegal rays .... **Potamalosa**

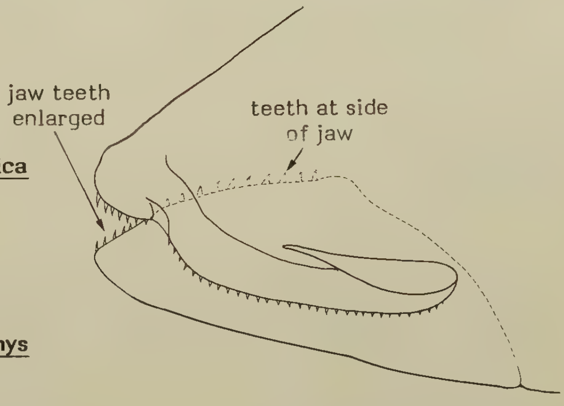
22b. Pelvic finrays i 6; second supra-maxilla deeper than maxilla blade; 4 branchiostegal rays.................................... **Hyperlophus**



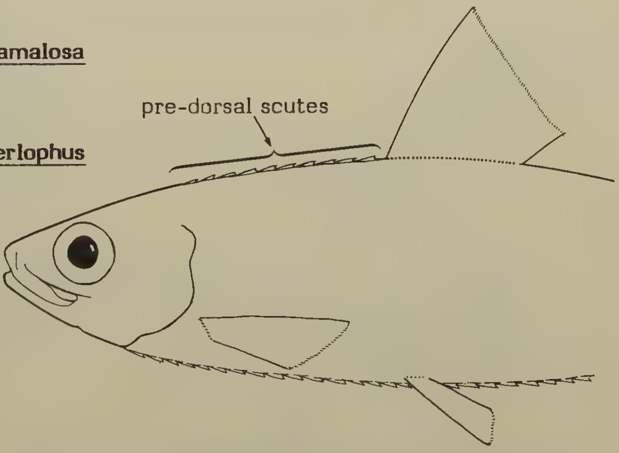
a. Ehirava



b. Dayella Fig. 8



Clupeichthys Fig. 9

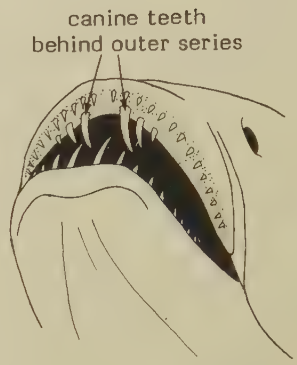


Potamalosa, Hyperlophus Fig. 10

Cynothrissa Regan, 1917

CLUP Cyno

Cynothrissa Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:203 (type: Cynothrissa mento Regan, design. by Jordan, 1920).



Diagnostic Features: Amongst the largest of West African pellonulines, reaching about 14 cm standard length. Belly with strong keel of scutes, the anterior scute beginning before base of first pectoral finray. Lower jaw prominent, with strong canines at symphysis; pre-maxillae with 2 to 4 backward-pointing canines on each side behind normal outer series of teeth. Lower gillrakers 16 to 35, usually shorter than corresponding gill filaments in adults. Closely resembles Odaxothrissa, which has only one large backward-pointing canine in the upper jaw and anterior scutes beginning under or behind base of last pectoral finray; resembles Pellonula vorax, which has gillrakers as long as corresponding gill filaments and enlarged but not canine-like teeth in jaws.

Biology, Habitat and Distribution: Freshwater, in West African rivers from Senegal to Angola. Predatory on smaller fishes, also probably aquatic insects and perhaps crustaceans.

Interest to Fisheries: Enter artisanal fisheries, but catches small.

Species: Since the synopsis by Regan (1917), two species have been consistently recognized, but there is now evidence of a third, rather slender species from Ivory Coast:

C. ansorgii (Boulenger, 1910), West African freshwaters
C. mento Regan, 1917, West African freshwaters
Cynothrissa species of Daget & Iltis, 1965, West African freshwaters.

Remarks: The presence of fang-like or canine teeth on the pre-maxillae behind the normal outer series is highly unusual in clupeid fishes. Such teeth are otherwise only found in the southeast Asian genus Clupeichthys.

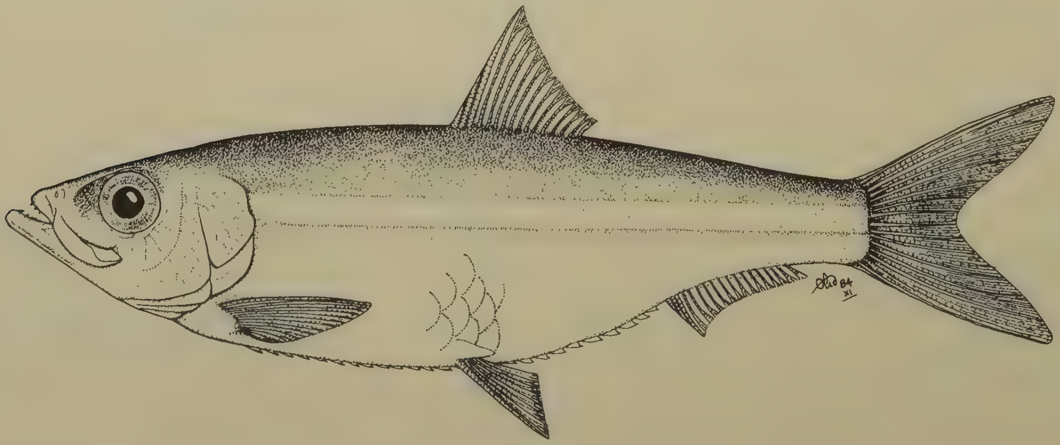
Cynothrissa ansorgii (Boulenger, 1910)

CLUP Cyno 1

Odaxothrissa ansorgii Boulenger, 1910, Ann.Mag.nat.Hist., (8)**6**:541 (Quanza River at Cambambe, Lucalla River at Kalenge, Bengo River at Cambiri, all Angola).

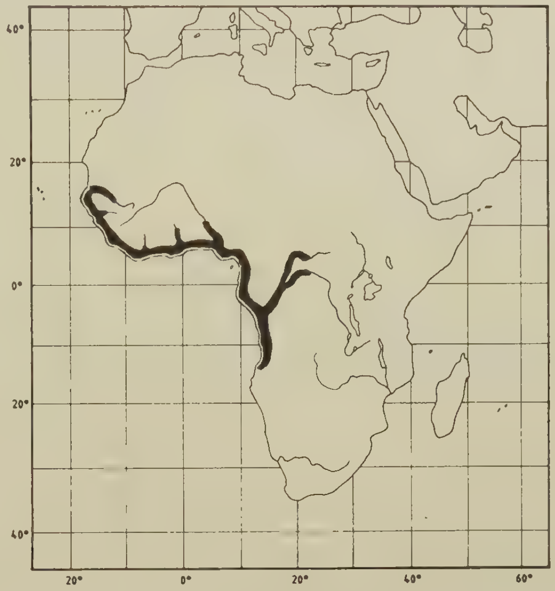
Synonyms: Odaxothrissa ansorgii:Boulenger, 1916:172, fig. 112 (Angola, excellent figure of a syntype); Cynothrissa ansorgii - Regan, 1917:204 (lower Congo and Angola); Poll, 1974:145 (synopsis); CLOFFA, 1984:42 (complete synonymy).

FAO Names: En - Ansorge's fangtooth pellonuline.



Diagnostic Features : Body moderate, often deep (depth 25% of standard length or more). Pre-pectoral scutes present. Lower jaw strongly projecting, with strong canines at symphysis; 2 to 4 strong backward-pointing canines on each side behind outer row of pre-maxillary teeth. Lower gillrakers 23 to 26, short (less than corresponding gill filaments). Anal finrays ii to iii, 14 to 16. Silver stripe along flank. Resembles *C. mento*, which has fewer gillrakers (16 to 19); also, *Pellonula vorax*, which lacks canines in the upper jaw and has longer gillrakers (equal to gill filaments). Species of *Odaxothrissa* have only one large canine on each side of the upper jaw and the first scute is behind the pectoral fin base.

Geographical Distribution : West African freshwaters (Senegal to Angola).



Habitat and Biology : Rivers and streams. More data needed.

Size : To 13 cm standard length.

Interest to Fisheries : Enters artisanal fisheries, but catches small.

Local Names : -

Literature : Fourteen references to this species are given in CLOFFA (1984:42).

Remarks : Meristic characters probably vary throughout the wide range of this species, but it remains very clearly separated from *C. mento* on gillraker numbers.

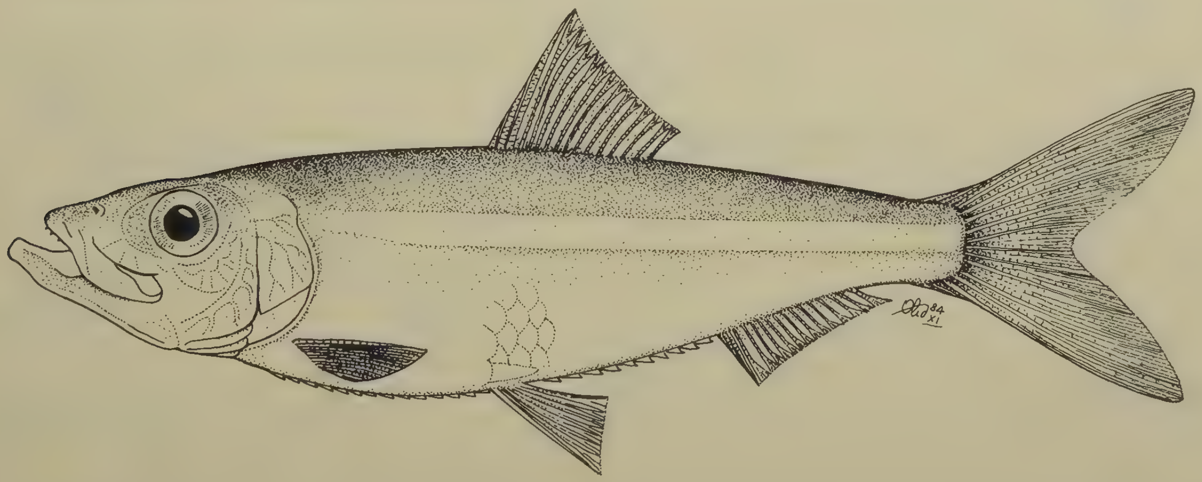
Cynothrissa mento Regan, 1917

CLUP Cyno 2

Cynothrissa mento Regan, 1917, *Ann.Mag.nat.Hist.*, (8)**19**:204, fig. 1 (head only) (Agberi, southern Nigeria).

Synonyms : *Cynothrissa mento* - Poll, 1974:146 (synopsis); CLOFFA, 1984:42 (complete synonymy, refs to anatomy, food, breeding, migrations, fisheries).

FAO Names : En - Nigerian fangtooth pellonuline.



Diagnostic Features : Body moderate, sometimes deep (depth 25% of standard length or more). Pre-pectoral scutes present. Lower jaw strongly projecting, with strong canines at symphysis; 2 to 4 strong backward-pointing canines on each side behind outer row of pre-maxillary teeth. Lower gillrakers 16 to 19, short (less than corresponding gill filaments). Anal finrays ii to iii, 16 to 19. Silver stripe along flank. Resembles *C. ansorgii*, which has more gillrakers (23 to 26); also, *Pellonula vorax* which lacks canines in the upper jaw and has longer gillrakers (equal to gill filaments). Species of *Odaxothrissa* have only one large canine on each side of the upper jaw and the first scute is behind the pectoral fin base.

Geographical Distribution : West African freshwaters (lower parts of Volta and Niger basins, also lower Benue and rivers of Cameroon; apparently not in Zaire system).

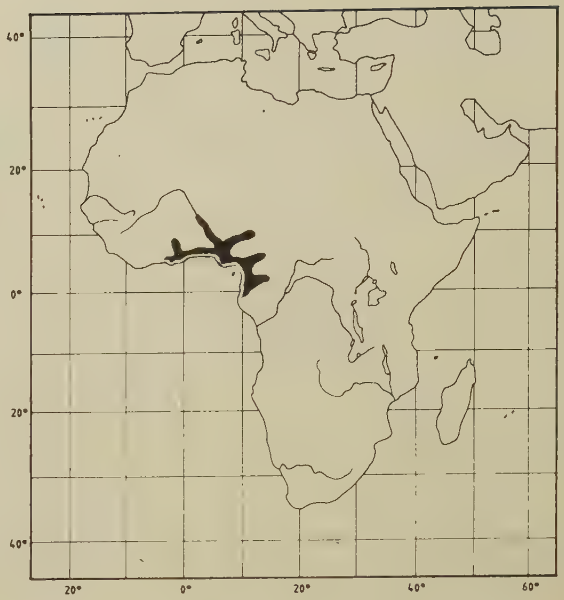
Habitat and Biology : Rivers and streams, also the man-made Lake Volta (but only in the most riverine parts, e.g. Yeji and Kete Krachi). Feeds on small fishes (*Pellonula*, also small cyprinids, cyprinodonts, schilbeids and even bagrid catfishes), including its own juveniles, also on aquatic insects. Possibly migrates upstream to breed. Growth in Lake Volta has been estimated at 7.3 mm a month.

Size : To 13 cm standard length.

Interest to Fisheries : Enters artisanal fisheries, but catches are small.

Local Names : -

Literature : Reynolds (1966, 1967, 1969 - fisheries; 1970 - food; 1971 - migration; 1974 - breeding); Petr & Reynolds (1969 - fisheries); 23 references to this species in CLOFFA (1984).



Cynothrissa species Daget & Iltis, 1965

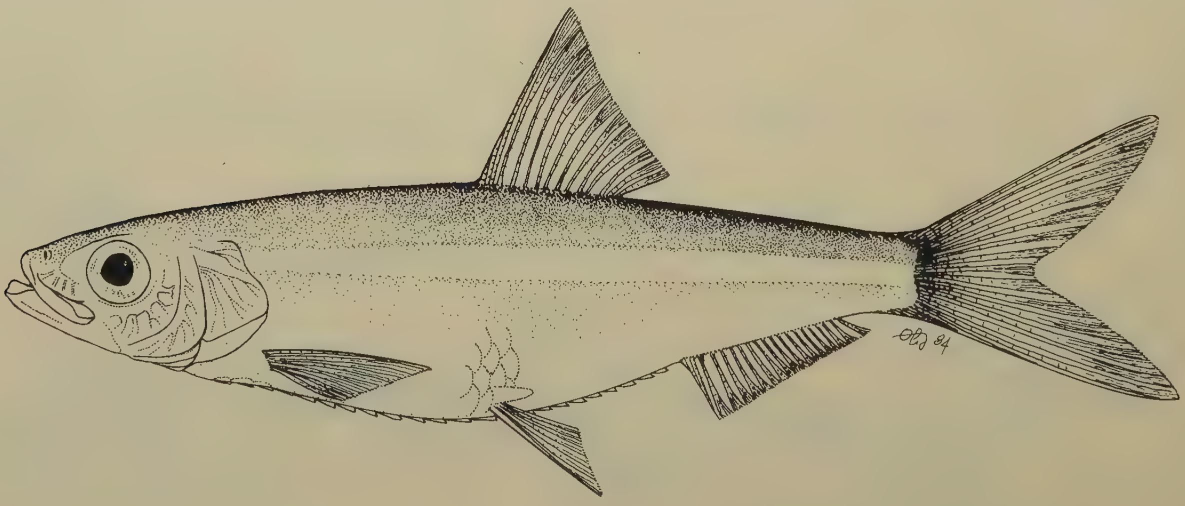
CLUP Cyno sp.

(AWAITING DESCRIPTION AND NAME)

Cynothrissa species Daget & Iltis, 1965, *Mém.Inst.fr.Afr.noire*, (74):50, fig. 27 (Lake Ebrié, Ivory Coast).

Synonyms : *Cynothrissa* species - CLOFFA, 1984:42.

FAO Names : En - Lake Ebrié fangtooth pellonuline.



Diagnostic Features : Body slender (20 to 23% of standard length). Pre-pectoral scutes present. Lower jaw strongly projecting, with strong canines at symphysis; 2 to 4 strong backward-pointing canines on each side behind outer row of pre-maxillary teeth. Lower gillrakers 28 to 33, long (equal to or more than corresponding gill filaments). Silver stripe along flank. Distinguished from *C. mento* and *C. ansorgii* by having more and longer gillrakers (cf. only 16 to 19 and 23 to 26 respectively, shorter than gill filaments). Resembles *Pellonula* until about 70 mm standard length, when canine teeth develop.

Geographical Distribution : West African freshwaters (Ivory Coast, in Lake Ebrié, but perhaps elsewhere also).

Habitat and Biology : Apparently able to tolerate salinity fluctuations of 0.6 to 24.6 ^{0}/oo (Lake Ebrié). More data needed.

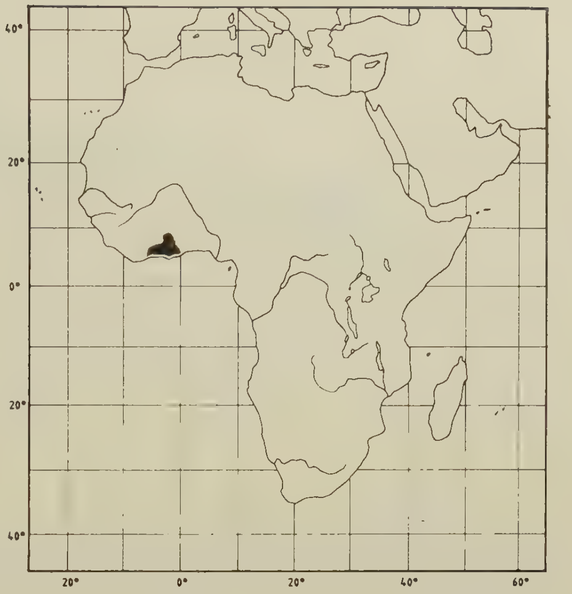
Size : To at least 10.1 cm standard length, usually 6 to 8 cm.

Interest to Fisheries : Presumably enters artisanal fisheries, but catches would be small.

Local Names : -

Literature : See under Synonyms.

Remarks : Daget & Iltis (1965) hesitated to name this species because the small and slender types of Pellonula leonensis Boulenger, 1916 might perhaps be its juveniles. However, the latter lack pre-pectoral scutes and if such scutes are consistently present in juvenile Cynothrissa, then P. leonensis belongs in the rather variable complex that includes P. afzeliusi and P. miri (see under P. leonensis).

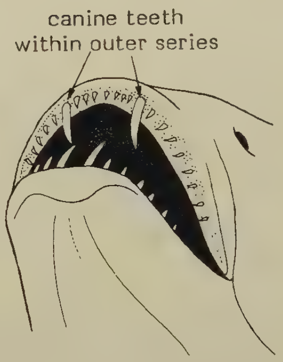


Odaxothrissa Boulenger, 1899

CLUP Odaxo

Odaxothrissa Boulenger, 1899, Ann.Mus.Congo, Zool., (1)**1**:64 (type: Odaxothrissa losera Boulenger).

Diagnostic Features : Amongst the largest of the West African pellonulines, reaching about 15 cm standard length. Belly with strong keel of scutes, the anterior scute beginning behind base of last pectoral finray. Lower jaw prominent, with strong canines at symphysis; pre-maxillae with one (rarely 2) canine teeth about halfway along normal outer series, curved and pointing backward. Lower gillrakers 18 to 24, shorter than corresponding gill filaments in adults. Closely resembles Cynothrissa, which has 1 to 4 backward-pointing canines behind normal outer pre-maxillary series, also pre-pectoral scutes present. Resembles Pellonula vorax, which has gillrakers as long as corresponding gill filaments and enlarged but not canine-like teeth.



Biology, Habitat and Distribution : Freshwater, in West African rivers (Congo system). Predatory on smaller fishes, also probably aquatic insects and perhaps crustaceans.

Interest to Fisheries : Enter artisanal fisheries, but catches small.

Species : Since the synopsis by Regan (1917), two species have been consistently recognized (but the distinction not very secure - see under O. losera):

O. losera Boulenger, 1899, West African freshwaters
O. vittata Regan, 1917, West African freshwaters.

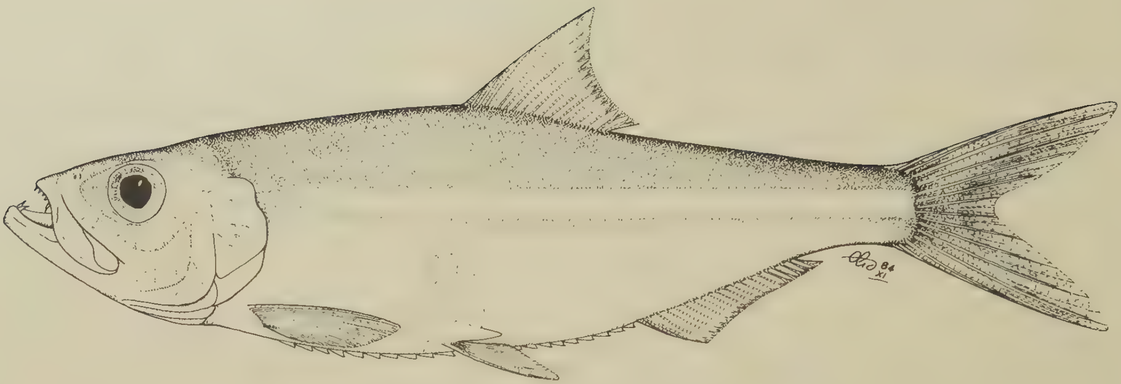
Odaxothrissa losera Boulenger, 1899

CLUP Odaxo 1

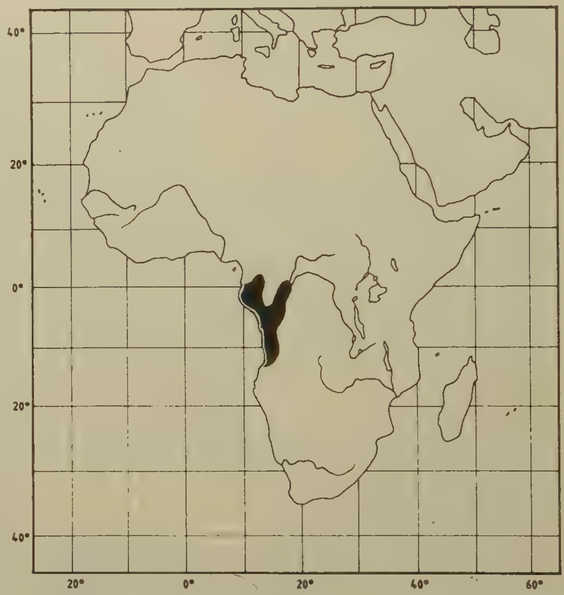
Odaxothrissa losera Boulenger, 1899, Ann.Mus.Congo, Zool., (1)**1**:64, pl. 31, fig. 1 (Coquilhatville = Mbandaka).

Synonyms : Odaxothrissa losera - Boulenger, 1909:160, fig. 128 (good figure of a syntype); Regan, 1917, 205 (juvenile syntype, Coquilhatville); Poll, 1974:146 (synopsis); CLOFFA, 1984:47 (complete synonymy, refs to habitat, food).

FAO Names : En - Losera fangtooth pellonuline.



Diagnostic Features : Body slender or moderate (depth about 22 to 29% of standard length). Scutes beginning behind base of last pectoral finray. Lower jaw strongly projecting, with strong canines at symphysis; one large canine tooth about halfway along normal pre-maxillary series (rarely a smaller one beside or a little behind it), curved and pointing backward. Lower gillrakers 18 to 21, short, less than corresponding gill filaments and the anterior ones reduced to stumps in large adults (more and longer gillrakers in juveniles). Silver stripe along flank. Resembles O. vittata, which has slightly more gillrakers (20 to 23 in adults); also Pellonula vorax, which lacks canines in the upper jaw and has one or more pre-pelvic scutes. Species of Cynothrissa have 1 to 4 canine teeth behind the normal outer pre-maxillary series.



Geographical Distribution : West African freshwaters (lower parts of Zaire River, from about Mbandaka to Braazaville, also the rivers of Gabon, Congo and perhaps Angola).

Habitat and Biology : Rivers and streams. More data needed (but see notes by Matthes, 1964; also Hulot, 1950 and Marlier, 1958 on food).

Size : To 13 cm standard length.

Interest to Fisheries : Enters artisanal fisheries, but catches small.

Local Names : CONGO: Losera; Lake Tumba: Luhelele.

Literature : Twenty-three references in CLOFFA (1984:47-48).

Remarks : Only the slightly lower gillraker count distinguishes this species from O. vittata, but in both species the gillrakers appear to become fewer and shorter in adults, the anterior rakers degenerating into mere stumps. Possibly O. vittata is merely an upper Congo form (subspecies ?) of O. losera. Poll (1974:146) gave 26 to 27 gillrakers for O. losera; a syntype of 7.7 cm standard length has 27 lower gillrakers, but larger specimens have 18 to 21 only (but 21 and 24 in two fishes of 11 cm standard length from Cameroon).

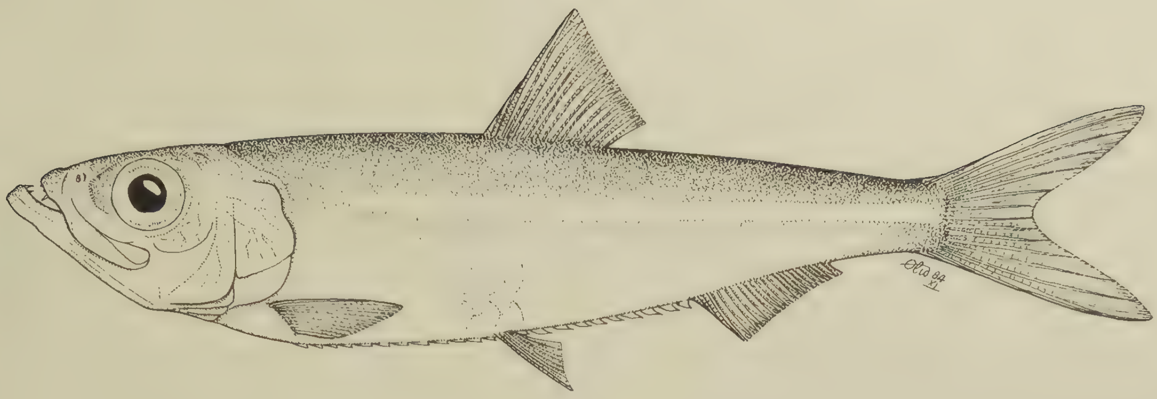
Odaxothrissa vittata Regan, 1917

CLUP Odaxo 2

Odaxothrissa vittata Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:205 (Banzyville = Yasanyama, Oubangui River).

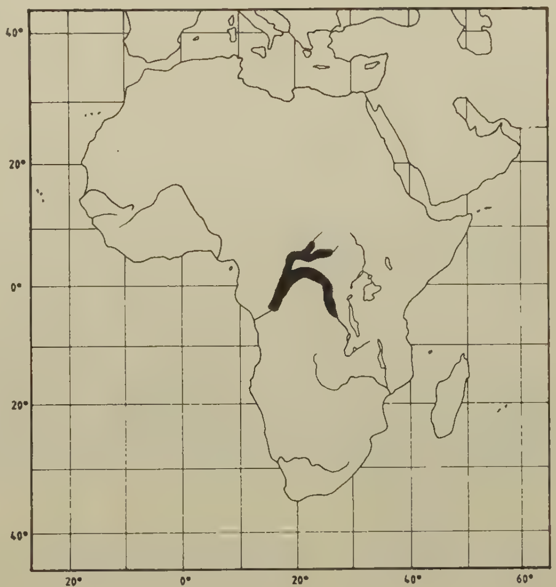
Synonyms : Odaxothrissa vittata - Poll, 1974:146 (synopsis); CLOFFA, 1984:48 (complete synonymy, ref. to ecology).

FAO Names : En - Regan's fangtooth pellonuline.



Diagnostic Features: Body slender or moderate (depth about 22 to 26% of standard length). Scutes beginning behind base of last pectoral finray. Lower jaw strongly projecting, with strong canines at symphysis; one large canine tooth about halfway along normal pre-maxillary series (rarely a smaller one beside or behind it), curved and pointing backward. Lower gillrakers 20 to 24, short, less than corresponding gill filaments and the anterior ones reduced to stumps in large adults (more and longer gillrakers in juveniles). Silver stripe along flank. Resembles O. losera, which has slightly fewer gillrakers (18 to 21 in adults); also Pellonula vorax, which lacks canines in the upper jaw and has one or more pre-pelvic scutes. Species of Cynothrissa have 1 to 4 canine teeth behind the normal outer pre-maxillary series.

Geographical Distribution: West African freshwaters (upper parts of Zaire River and its tributaries, e.g. Ubangi and Lualaba, also Sangha).



Habitat and Biology: Rivers and streams. More data needed.

Size: To 13 cm standard length, perhaps more.

Interest to Fisheries: Enters artisanal fisheries, but catches small.

Local Names: -

Literature: Fifteen references in CLOFFA (1984:48).

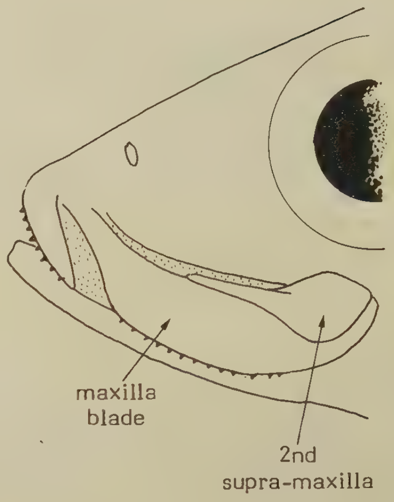
Remarks: Not certainly distinct from O. losera (see under that species).

Pellonula Günther, 1868

CLUP Pellon

Pellonula Günther, 1868, *Cat.Fish.Brit.Mus.*, **7**:82, 452 (type: *Pellonula vorax* Günther).

Diagnostic Features: Small or medium-sized West African pellonulines, reaching about 12 cm (usually 6 to 8 cm). Belly with strong keel of scutes, the anterior scute sometimes beginning before base of first pectoral finray. Lower jaw slightly or rather distinctly projecting, with strong but not canine teeth at symphysis; premaxillae with a single (outer) row of teeth, small or well-developed but never canine-like; maxilla blade deep, its depth about 3 times in its length, second supra-maxilla paddle-shaped. Lower gillrakers 20 to 36, longer than corresponding gill filaments. Scales small, in lateral series 38 to 44. Differs from *Cynothrissa* and *Odaxothrissa* in the lack of canine teeth in the jaws; differs from *Nannothrissa* and *Sierrathrissa* in having i 7 pelvic finrays (cf. i 6) and the pelvic fin insertion below or behind the dorsal fin origin (cf. in front); *Poecilothrissa* has fewer scales (27 to 34).



Biology, Habitat and Distribution: Freshwater, in West African rivers from Senegal to Angola, but in some cases enters brackishwater of estuaries and may even appear along beaches.

Interest to Fisheries: Enter artisanal fisheries, but catches small.

Species: Revisional work is urgently needed, but two species (or species complexes) can be clearly distinguished, based on the form of the pre-maxillary teeth and presence or absence of pre-pectoral scutes:

P. leonensis Regan, 1917, West African freshwaters
P. vorax Günther, 1868, West African freshwaters.

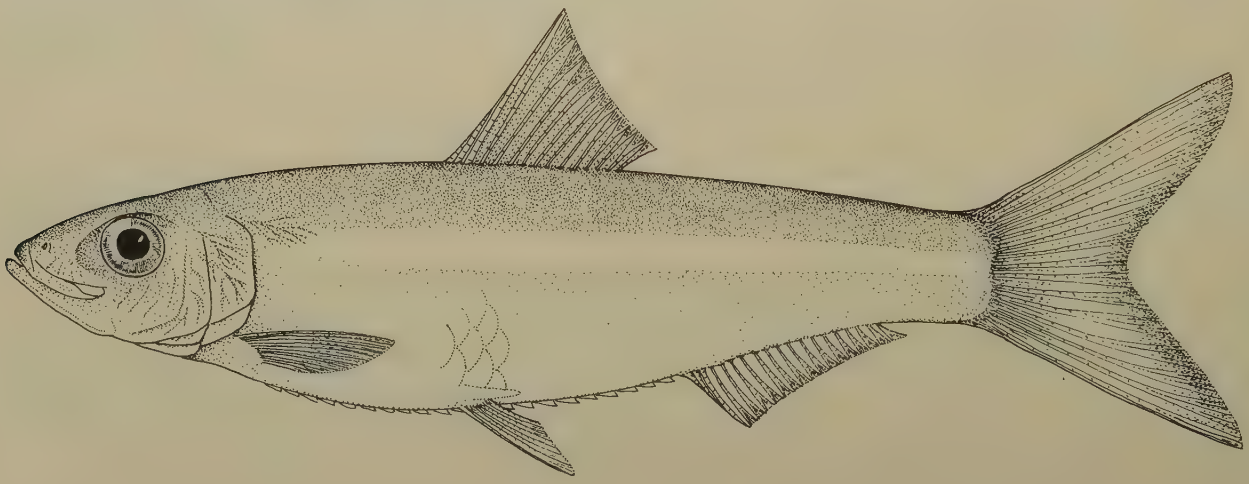
Pellonula leonensis Boulenger, 1916

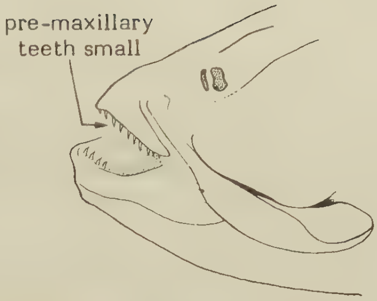
CLUP Pellon 1

Pellonula leonensis Boulenger, 1916, *Cat.f.-w.Fish.Africa*, **4**:172, fig. 111 (Sherbo District, Sierra Leone).

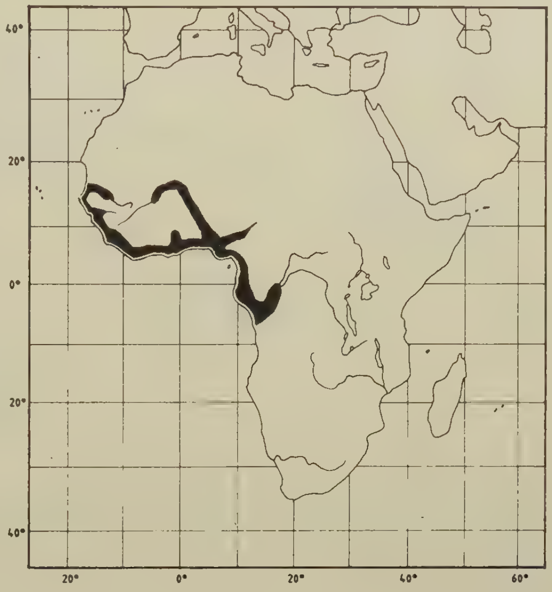
Synonyms: *Pellonula afzeliusi* Johnels, 1954:351 (Gambia River); Poll, 1974:146 (Gambia, Lake Ebrié); Poll, Teugels & Whitehead, 1984:48 (complete synonymy); *Microthrissa miri* Daget, 1954:67, fig. 12 (Diafarabe, 14°N, upper Niger, Mali); *Pellonula miri*:Poll, 1974:146 (synopsis); Poll, Teugels & Whitehead, 1984:49 (complete synonymy); *Pellonula leonensis* - CLOFFA, 1984:49 (complete synonymy, Sierra Leone only; *P. miri* and *P. afzeliusi* recognized as distinct species).

FAO Names: En - Smalltoothed pellonula.





Diagnostic Features : Body slender to moderately deep (depth 17 to 30% of standard length). Scutes beginning behind base of first (usually behind last) pectoral finray, 10 to 13 + 6 to 10 = 17 to 23. Lower jaw very slightly projecting, teeth at symphysis only slightly enlarged; pre-maxillary teeth small, curved inward, only the tips usually apparent, no strongly marked indentation at centre of jaw. Lower gillrakers 20 to 30, long (equal to or longer than corresponding gill filaments). Silver stripe along flank. Resembles P. vorax, which has larger and straighter teeth, often pointing forward, and scutes before pectoral fin bases. Absence of large canine teeth in upper jaw (within or behind normal outer pre-maxillary series) distinguishes it from Odaxothrissa and also Cynothrissa (which has pre-pectoral scutes). Microthrissa species are deep-bodied and have a much more slender maxilla. See CLUP Pellon 1, Fishing Area 34.



Geographical Distribution : West African freshwaters (Senegal to Zaire, upper reaches of Niger and lower parts of Benue, but apparently not in upper parts of Congo system).

Habitat and Biology : Chiefly rivers and streams, also man-made and natural lakes and lagoons; apparently able to tolerate moderate or even quite high salinities (reported from the beaches at Hann near Dakar and near Pointe Noire, Congo). Breeds July to September in Lake Volta. According to Daget (1954 - as Microthrissa miri) in the upper Niger the fishes do not leave the main river to enter floodwater pools; nevertheless the species appears well-established in Lake Volta and to some extent in Kainji Lake (Nigeria). Feeds on terrestrial and aquatic insects, especially Povilla nymphs in Lake Volta, also ostracods and entomostracans; stomachs containing clupeid fish scales may represent cannibalism. Breeds July to September in Lake Volta.

Size : To 8.5 cm standard length.

Interest to Fisheries : Enters artisanal fisheries, but catches small.

Local Names : -

Literature : Teugels & Thys van den Avdenaerde (1979 - anatomy); all references to this species (separately as afzeliusi, leonensis and miri) to about 1981 are given in CLOFFA (1984).

Remarks : Great uncertainty surrounds the name of this species because the two slender syntypes of P. leonensis are juveniles. Rather similar slender fishes, again without pre-pectoral scutes but with gillraker counts up to 35 (27 to 28 in the syntypes) occur in Ivory Coast, Cameroon, Gabon and Congo. Unfortunately, these frequently occur with apparently similar fishes that possess pre-pelvic scutes (but not with P. vorax-type teeth); among the latter are some with canine teeth beginning to fold inward and also larger adults with complete Cynothrissa-type canines. The latter, being slender fishes, are assumed here to be the Cynothrissa species of Lake Ebrié; those without canines are assumed to be either Cynothrissa in which canines do not always develop, or else another species of Pellonula that shares the caracters of both P. leonensis (pre-maxillary teeth small and curved) and of P. vorax (pre-pectoral scutes present).

Until this is resolved it is assumed that there are three subspecies of P. leonensis:

P. leonensis leonensis: body slender (depth 17.7 to 18% of standard length); lower gillrakers 27 to 28; syntypes of P. leonensis from Sierra Leone, coastal.

P. leonensis afzeliusi: body moderate or deep (depth 21.7 to 30.2% of standard length); lower gillrakers 21 to 29; Senegal to Niger River, coastal.

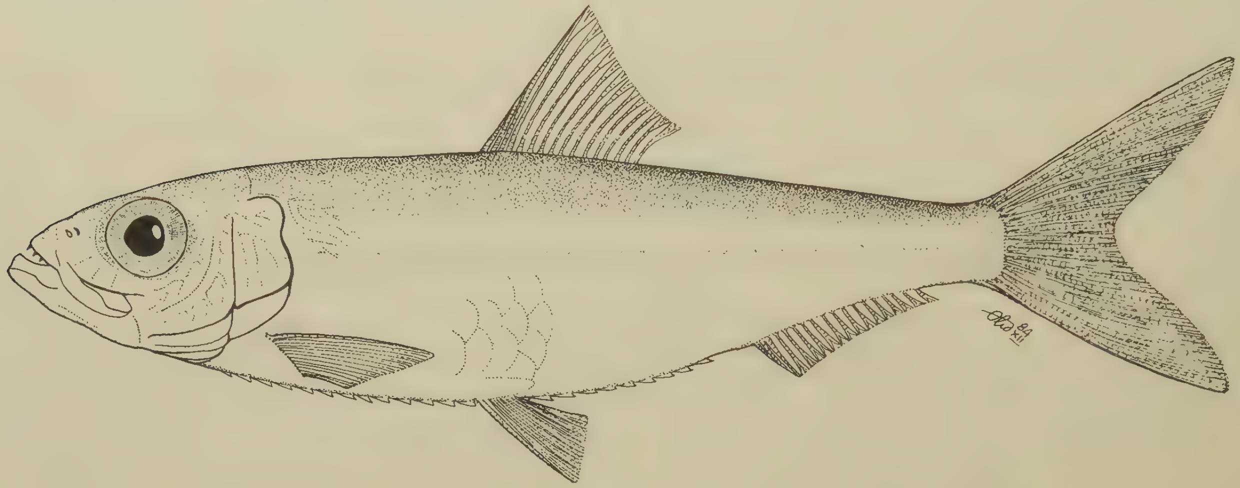
P. leonensis miri: body moderate or deep (depth 23.8 to 28.5% of standard length); lower gillrakers 20 to 23; upper parts of Niger and Benue.

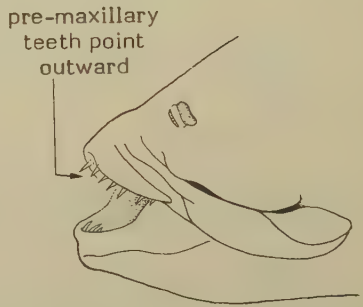
Pellonula vorax Günther, 1868

Pellonula vorax Günther, 1868, Cat.Fish.Brit.Mus., 7:452 ("West Africa").

Synonyms : Pellonula stanleyana Regan, 1917:201 (Stanley Falls, but in fact Cette Cama); Pellonula vorax:Boulenger, 1909:156, fig. 124 from Steindachner (poor) (Niger to Congo, but some specimens misidentified); Regan, 1917:200 (Boulenger specimens re-identified, but P. leonensis material included); Poll, 1974:146 (synopsis); CLOFFA, 1984:49 (complete synonymy, refs to breeding).

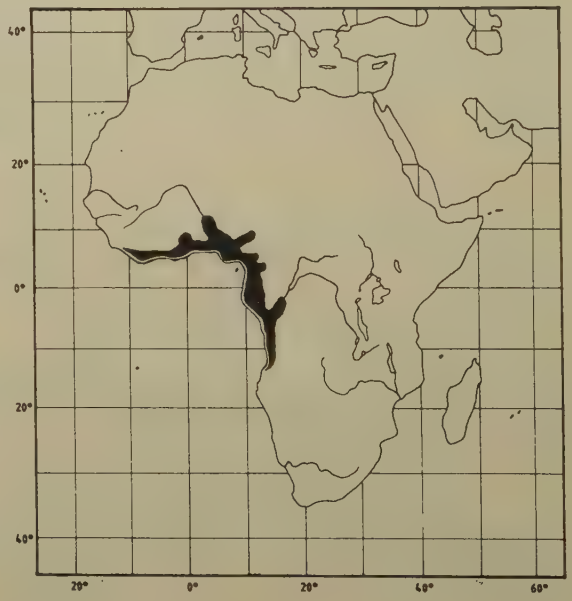
FAO Names : En - Bigtoothed pellonula.





Diagnostic Features : Body moderate or fairly deep (depth 23 to 30% of standard length). Scutes beginning at isthmus, the first usually long, 11 to 15 + 9 to 11 = 20 to 25 total. Lower jaw slightly projecting, teeth at symphysis large in large fishes; pre-maxillary teeth strong, fairly straight, pointing forward in some fishes and an indented toothless gap at centre of jaw. Lower gillrakers 25 to 36, long (usually equal to or longer than corresponding gill filaments). Silver stripe along flank. Resembles P. leonensis, which has small and inward-curving teeth and no pre-pectoral scutes. Absence of large canine teeth in the upper jaw (within or behind normal outer pre-maxillary series) distinguishes it from Cynothrissa and also Odaxothrissa (which lack pre-pectoral scutes).

Geographical Distribution : West African freshwaters (lower parts of rivers from Ivory Coast to Angola); the Stanley Falls record (P. stanleyana) was an error.



Habitat and Biology : Rivers and streams. More data needed.

Size : To 12 cm standard length, perhaps more; usually to 10 cm.

Interest to Fisheries : Enters artisanal fisheries, but catches small.

Local Names : -

Literature : Numerous references to this species; the literature to 1981 is given in CLOFFA (1984).

Remarks : In all samples the prominent and almost straight pre-maxillary teeth are correlated with the presence of pre-pectoral scutes. The range of the species is now extended to Ivory coast, thus broadly overlapping that of the less easily defined P. leonensis.

Nannothrissa Poll, 1965

CLUP Nann

Nannothrissa Poll, 1965, Rev.Zool.Bot.afr., **72**(3-4):309 (type: Microthrissa parva Regan).

Diagnostic Features : Dwarf pellonulines, reaching at most about 4 cm standard length (mature at only 2.2 cm in one species). Belly with very strong keel of scutes, the anterior scute beginning before base of first pectoral finray. Lower jaw prominent, teeth absent; no teeth on pre-maxillae, lower edge of maxilla, vomer or tongue. Lower gillrakers 20 to 31. Resembles Pellonula, which has pre-maxillary teeth and i 7 pelvic finrays (cf. i 6).

Biology, Habitat and Distribution : Freshwater, in West African rivers and lakes (middle Zaire River and associated lakes); both species are known from acid waters (pH 4-5).

Interest to Fisheries : Probably none.

Species : Poll & Roberts (1976) recognized two species which appear to be separable on numbers of gillrakers, anal finrays and scales; however, preserved specimens are few:

N. parva (Regan, 1917), West African freshwaters
N. stewarti Poll & Roberts, 1976, West African freshwaters.

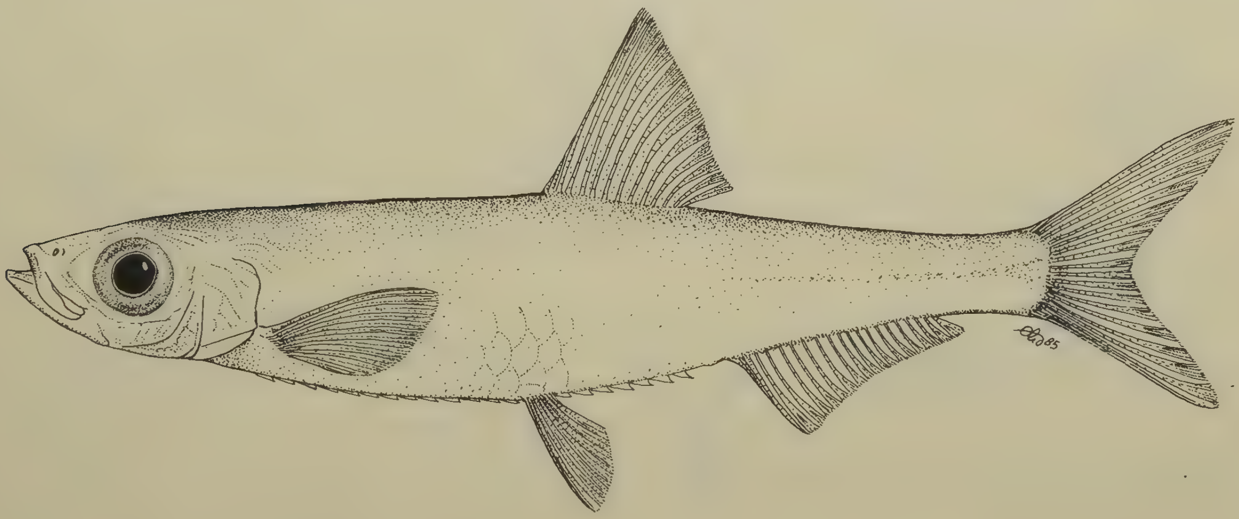
Nannothrissa parva (Regan, 1917)

CLUP Nann 1

Microthrissa parva Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:202 (Zaire River at Coquilhatville = Mbandaka, also Lake Tumba).

Synonyms : Microthrissa parva:Marlier, 1958:375 (Lake Tumba); Matthes, 1964:21 (Lake Tumba, ecology); Nannothrissa parva:Poll, 1974:150 (synopsis); CLOFFA, 1984 (complete synonymy, refs to habitat, food).

FAO Names : En - Lake Tumba dwarf sprat.



Diagnostic Features : Body slender (depth about 20% of standard length). Scutes beginning at isthmus (or just behind), very strongly keeled (even at only 1.7 cm standard length), 13 to 15 + 6 to 8. Lower jaw projecting, toothless; no teeth on pre-maxillae or maxillae; second supra-maxilla as deep as maxilla blade and with long slender anterior shaft. Lower gillrakers 24 to 31. Pelvic fin with i 6 finrays, its insertion about half eye diameter before dorsal fin origin; anal finrays 20 to 22. Scales in lateral series 35 to 40. Differs from N. stewarti in having more gillrakers (cf. 20 to 23) more anal finrays (cf. 17 to 19) and more scales (cf. 34 to 35). Resembles juveniles of Pellonula vorax, also of Cynothrissa, Odaxothrissa, Microthrissa, Poecilothrissa and Potamothrissa, but even small individuals of these have pre-maxillary teeth.

Geographical Distribution : West African freshwaters (Zaire River at Mbandaka, Lake Tumba; Ruki and Oubangui rivers *fide* Poll, 1974:150 and the Tshuapa River at Ikela *fide* Matthes, 1964).

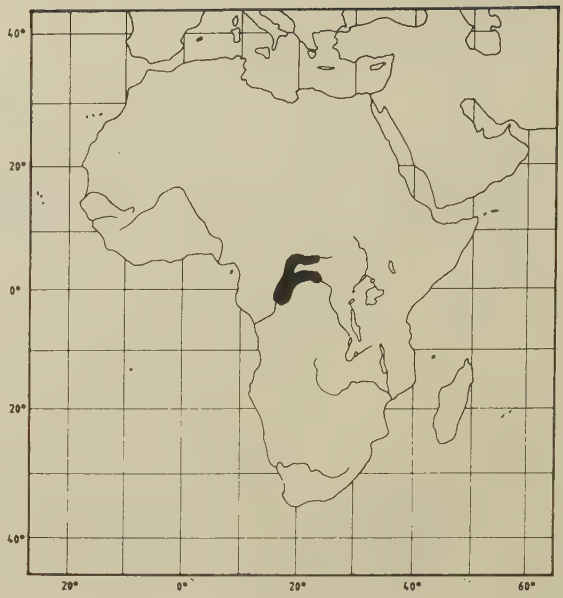
Habitat and Biology : Rivers and lakes, apparently in both running and still water, often in huge schools (Lake Tumba). Feeds on plankton (unicellular algae, diatoms and especially copepods, but also hydracarians and aquatic insects). Breeds in Lake Tumba, ripe fishes being caught in late August and ripe and some spent fishes occurring in about mid-September (Matthes, 1964).

Size : To 4.2 mm standard length.

Interest to Fisheries : Hardly of much significance, although occurring in sometimes dense shoals.

Local Names : ZAIRE: Mempesu, Isandja (Lake Tumba).

Literature : Fourteen references in CLOFFA (1984).



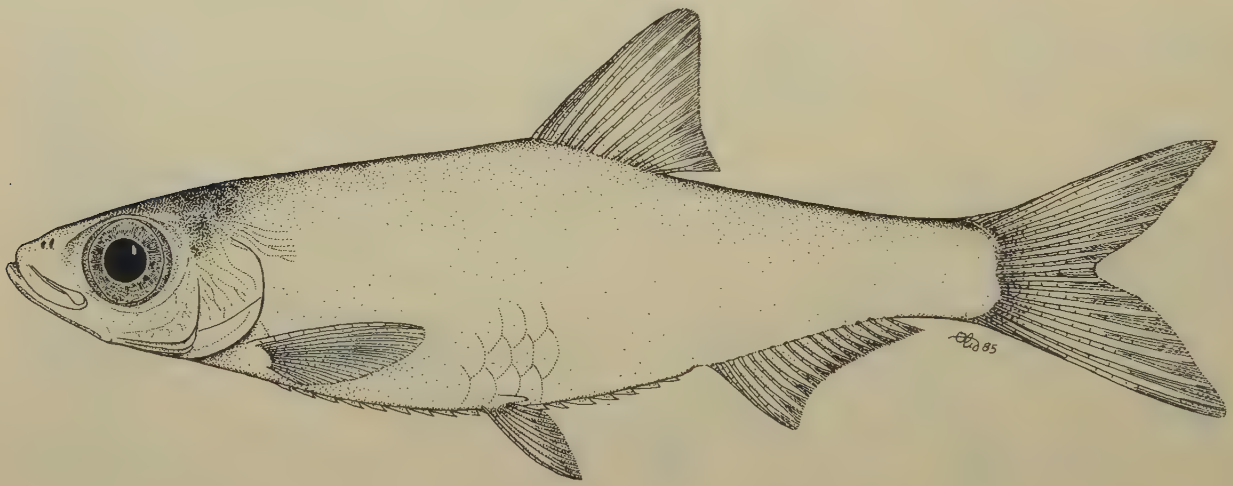
Nannothrissa stewarti Poll & Roberts, 1976

CLUP Nann 2

Nannothrissa stewarti Poll & Roberts, 1976, *Rev.Zool.afr.*, **90**(1):236 (Lake Mai-ndombe, Zaire system).

Synonyms : *Nannothrissa stewarti* - CLOFFA, 1984:47 (complete synonymy).

FAO Names : En - Mai-ndombe dwarf sprat.



Diagnostic Features : Body slender or moderate (depth about 25% of standard length). Scutes a little behind isthmus, very strongly keeled (even at 2.2 cm standard length), 9 + 7 to 9. Lower jaw very slightly projecting, toothless; no teeth on pre-maxillae or maxillae; second supra-maxilla as deep as maxilla blade and with long slender anterior shaft. Lower gillrakers 20 to 23. Pelvic fin with i 6 finrays, its insertion just below dorsal fin origin; anal finrays 17 to 19. Scales in lateral series 34 or 35. Differs from *N. parva* in having fewer gillrakers (cf. 24 to 31), fewer anal finrays (cf. 20 to 22) and fewer scales (cf. 35 to 40). Resembles juveniles of *Pellonula vorax*, also of *Cynothrissa*, *Odaxothrissa*, *Microthrissa*, *Poecilothrissa* and *Potamothrissa*, but even small individuals of these have pre-maxillary teeth.

Geographical Distribution : West African freshwaters (Lake Mai-ndombe or Inongo near Ipeke, Zaire system).

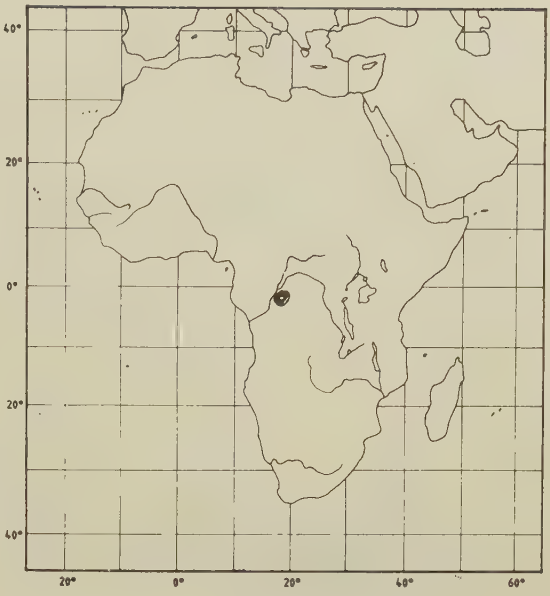
Habitat and Biology : Lacustrine in acid waters (pH 4). More specimens and data needed.

Size : To 2.25 cm standard length.

Interest to Fisheries : -

Local Names : -

Literature : Apparently not mentioned since its original description in 1976.

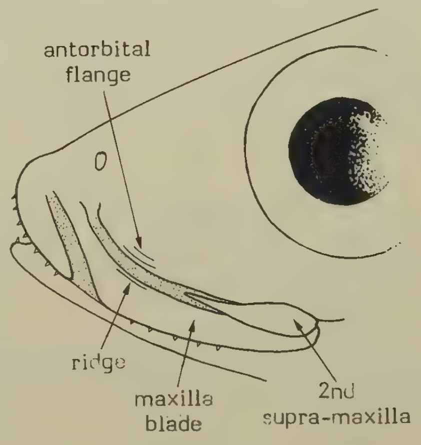


Poecilothrissa Regan, 1917

CLUP Poec

Poecilothrissa Regan, 1917, *Ann.Mag.nat.Hist.*, (8)**19**:201 (type: *Poecilothrissa congica* Regan).

Diagnostic Features : Small pellonulines, reaching about 5 cm standard length. Belly with fairly strong keel of scutes, the anterior scute beginning under or before the base of the last pectoral finray. Lower jaw only slightly or not at all prominent, rising steeply in mouth, with small teeth at front; pre-maxillae with a single row of small teeth; maxilla blade slender, its depth more than 3 times in its length, its upper edge with a distinct flange against which the lower edge of the antorbital bone curves outward; second supra-maxilla small, spatulate, with a long anterior shaft. Lower gillrakers 17 to 24. Pelvic finrays i 7, its insertion a little before dorsal fin origin. Scales large, in lateral series 27 to 34. Resembles *Microthrissa* and *Potamothrissa*, which have more scales (36 to 42), also *Microthrissa* is deep-bodied and *Potamothrissa* has almost no anterior shaft to the second supra-maxilla. *Pellonula* has a deeper maxillary blade and a more diamond-shaped second supra-maxilla.



Biology, Habitat and Distribution : Freshwater, in West African rivers (most parts of Zaire system) also lakes (Lake Tumba, Lake Mweru); schooling.

Interest to Fisheries : Little or none.

Species : In the review by Poll (1974), three species were recognized, but Poll, Teugels & Whitehead (i.e. CLOFFA, 1984:50) added *P. eupleura* (Löhnberg & Rendahl, 1920) from the 'lower Congo'; however, it seems more likely that the four known specimens are *P. congica*:

P. centralis Poll, 1974, West African freshwaters
P. congica Regan, 1917, West Arican freshwaters
P. moeruensis Poll, 1948, West African freshwaters.

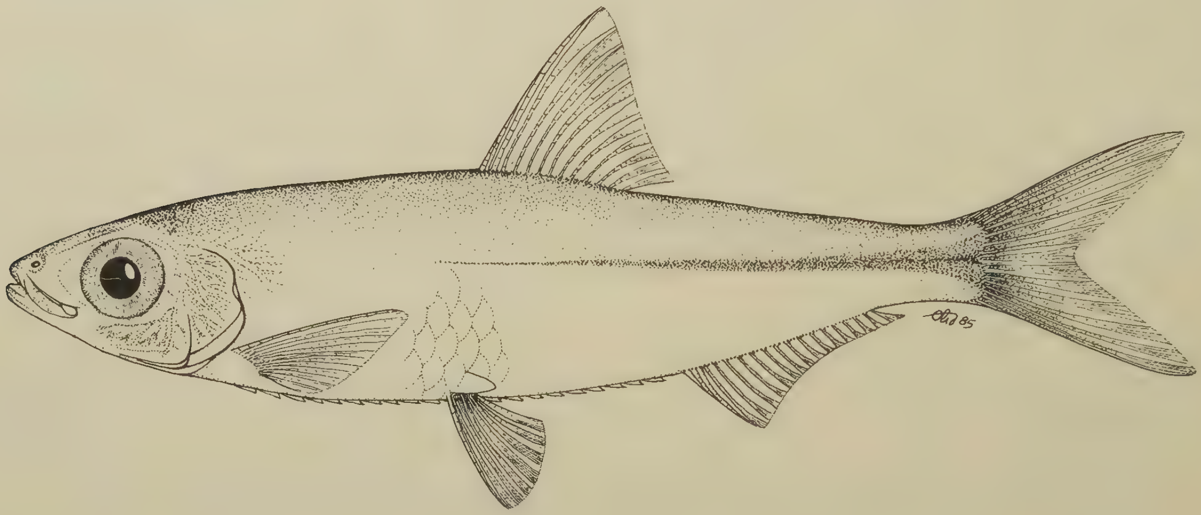
Poecilothrissa centralis Poll, 1974

CLUP Poec 1

Poecilothrissa centralis Poll, 1974, Bull.Acad.r.Belg.Cl.Sci., (5)60:151, fig. 1, map 1 (Lake Tumba region and Ruki River, Zaire system).

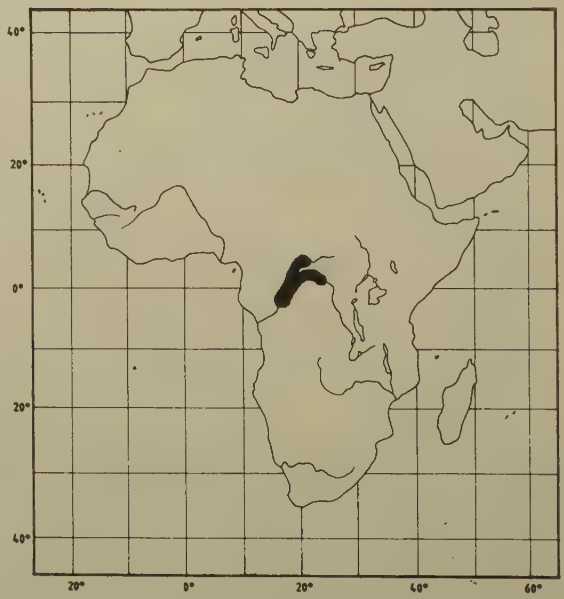
Synonyms : Poecilothrissa congica:Regan, 1917:202 (one of the syntypes misidentified); Poecilothrissa centralis - CLOFFA, 1984:50 (complete synonymy).

FAO Names : En - Central Zaire pellonuline.



Diagnostic Features : Body slender (depth 20 to 24% of standard length). Scutes strongly keeled, beginning under pectoral fin base, 10 + 10 or 11. Snout rather acute. Lower jaw slightly projecting, with small teeth; pre-maxillae with a single row of small teeth; maxilla slender, its blade a little over 3 times as long as deep, upper edge slightly ridged (flared outward); second supra-maxilla slender, spatulate, with distinct anterior shaft. Lower gillrakers 21 to 24. Differs from P. congica mainly in having a sharper, more acute snout and more gillrakers (cf. only 17 to 19, rarely 20 in P. congica). Nannothrissa parva from the same area has no teeth on the pre-maxillae.

Geographical Distribution : West African freshwaters (restricted to the region of Lake Tumba and the Ruki River, also the Zaire River at Mbandaka and its nearby tributary the Busira as far up as Bokungu on the Tshuapa branch).



Habitat and Biology : Rivers and lakes, apparently in both running and still water; like Nannothrissa parva, it seems to occur in rather acid waters. More data needed.

Size : To 5.7 cm standard length.

Interest to Fisheries : Probably none.

Local Names : -

Literature : Apparently not mentioned since its description in 1974.

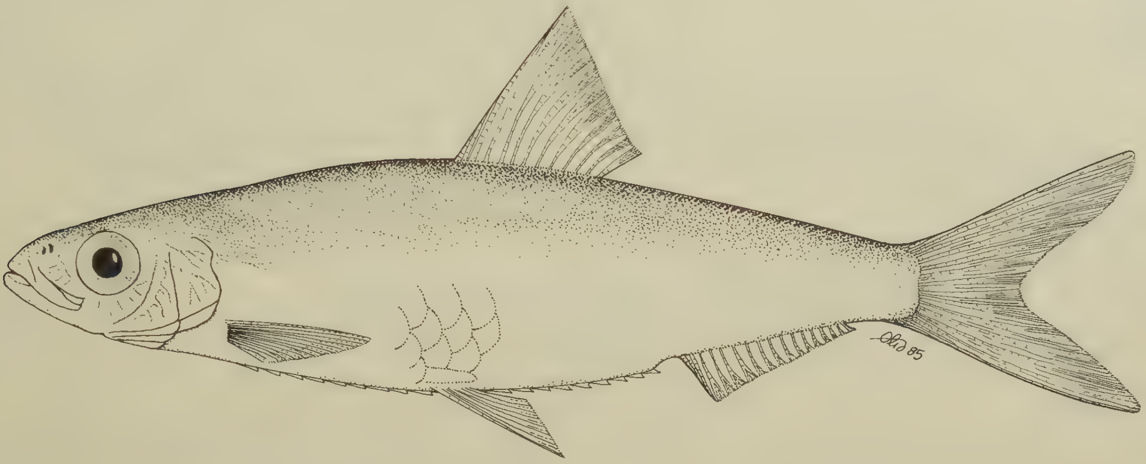
Poecilothrissa congica Regan, 1917

CLUP Poec 2

Poecilothrissa congica Regan, 1917, *Ann.Mag.nat.Hist.*, (8)**19**:202 (Coquilhatville = Mbandaka and Monsembe, Zaire system).

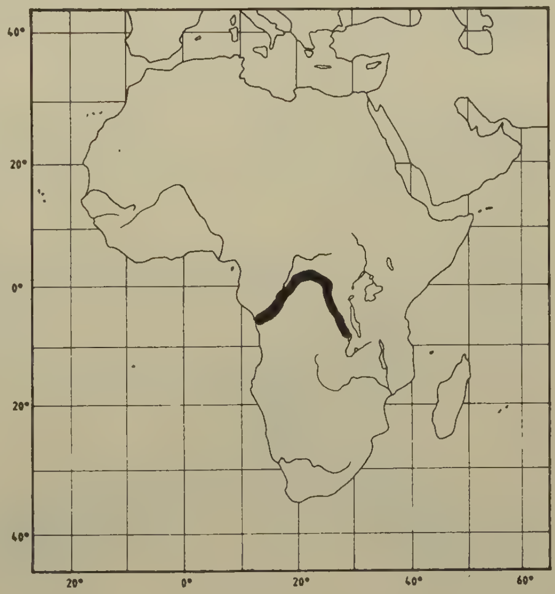
Synonyms : *Poecilothrissa congica* - Poll, 1974:147 (synopsis); CLOFFA, 1984:50 (complete synonymy, refs to habitat and anatomy). Possibly *Microthrissa eupleura* Löhnberg & Rendahl, 1920 is this species, in which case the name should be *P. eupleura*.

FAO Names : En - Bigscale pellonuline.



Diagnostic Features : Body slender (depth about 20 to 24% of standard length). Scutes strongly keeled, beginning under pectoral fin base, 11 or 12 + 9 or 10. Snout rather blunt. Lower jaw not projecting, included in upper when mouth closed, with small teeth; pre-maxillae with a single row of small teeth; maxilla slender, its blade more than 3 times as long as deep, upper edge quite strongly ridged (flared outward); second supra-maxilla slender, spatulate, with distinct anterior shaft. Lower gillrakers 17 to 19 (rarely 20). Differs from *P. centralis* and *P. moeruensis* in having a distinctly blunter snout, the lower jaw not projecting; also fewer gillrakers in *P. centralis* (cf. 21 to 24). Species of *Potamothrissa* have little or no anterior shaft to the second supra-maxilla, species of *Microthrissa* are much deeper-bodied, and other pellonulines have a deeper maxilla blade without a dorsal flange.

Geographical Distribution : Freshwater, in West African rivers (most of Zaire system, but apparently absent from the Lake Tumba area (*P. centralis*) or in the Luapula-Mweru system (*P. moeruensis*); known from almost the mouth of the Zaire (around Boma) to the upper parts of the Lualaba).



Habitat and Biology : Rivers, but perhaps not in lakes. More data needed.

Size : To about 6 cm standard length.

Interest to Fisheries : Probably none.

Local Names : -

Literature : Twenty references to the species in CLOFFA (1984).

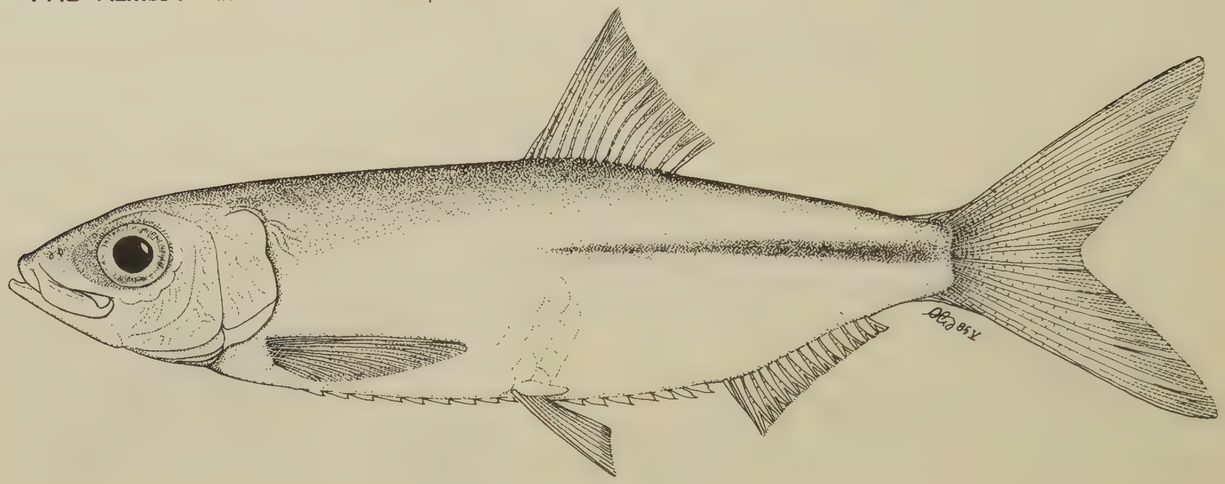
Poecilothrissa moeruensis Poll, 1948

CLUP Poec 3

Poecilothrissa moeruensis Poll, 1948, *Bull.Mus.r.Hist.nat.Belg.*, (24):21:15, fig. 6 (Lake Mweru off Kilwa Island).

Synonyms : *Poecilothrissa moeruensis* - CLOFFA, 1984:50 (complete synonymy).

FAO Names : En - Lake Mweru sprat.



Diagnostic Features : Body slender (depth about 20 to 25% of standard length). Scutes strongly keeled, beginning just behind base of last pectoral finray, about 10 + 8. Snout rather pointed. Lower jaw slightly projecting, with small teeth; pre-maxillae with a single row of small teeth; maxilla slender, its blade a little more than 3 times longer than deep, upper edge a little ridged (flared outward); second supra-maxilla slender, spatulate, with distinct anterior shaft. Lower gillrakers 18 to 20. Resembles small *P. congica*, which has a much blunter snout and more anal finrays (18 to 21; cf. 16 to 18). Conspecific in Lake Mweru with *Limnothrissa stappersi*, which has more gillrakers (22 to 25) and no distinct keel before the pelvic fins.

Geographical Distribution : Freshwater, in one West African lake and perhaps its tributaries (Lake Mweru).

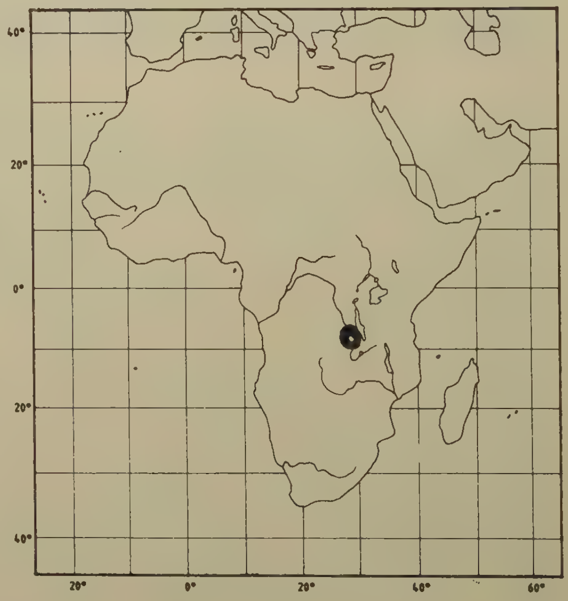
Habitat and Biology : Lacustrine, but perhaps also in small streams or rivers feeding Lake Mweru. More data needed.

Size : To about 3.5 cm standard length.

Interest to Fisheries : Clupeoid catches in Lake Mweru have increased since 1980 and may now yield 3 500 tons annually; *P. moeruensis* must contribute to this.

Local Names : -

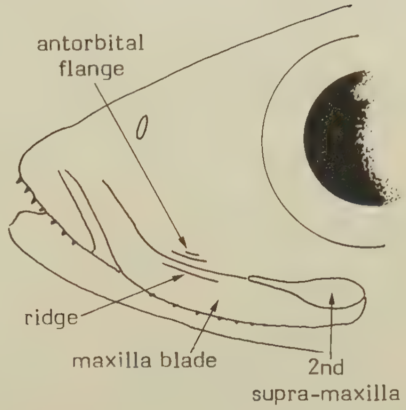
Literature : Nine references to the species in CLOFFA (1984).



Microthrissa Boulenger, 1902

Microthrissa Boulenger, 1902, Ann.Mus.Congo, Zool., (1)**2**:26 (type: M. royauxi Boulenger).

Diagnostic Features: Small or medium-sized fairly deep-bodied West African pellonulines, reaching about 10 cm in one species. Belly with strong keel of scutes, the anterior scute(s) beginning before base of first pectoral finray in some. Lower jaw not projecting, with small teeth at symphysis; pre-maxillae with a single (outer) row of small teeth and a few small teeth on maxilla; maxilla blade long and slender (depth 3 or more times in length), upper edge with a ridge flared outward; blade of second supra-maxilla small and spatulate. Lower gillrakers 14 to 22. Scales small, 36 to 42 in lateral series. Resembles Poecilothrissa, which has fewer scales (27 to 34) and a more slender body (22 to 24% of standard length), and Potamothrissa, which has teeth at the sides of the lower jaw and almost no shaft to the second supra-maxilla. Other pellonulines have a deeper maxilla blade (e.g. Pellonula) or are less trenchantly keeled.



Biology, Habitat and Distribution: Freshwater, in West African rivers (Congo/Zaire system, also Ghana).

Interest to Fisheries: Enter artisanal fisheries, but catches small.

Species: Poll (1974:147-148) recognized 2 species in the Congo/Zaire system, but a Ghanaian species has now been found:

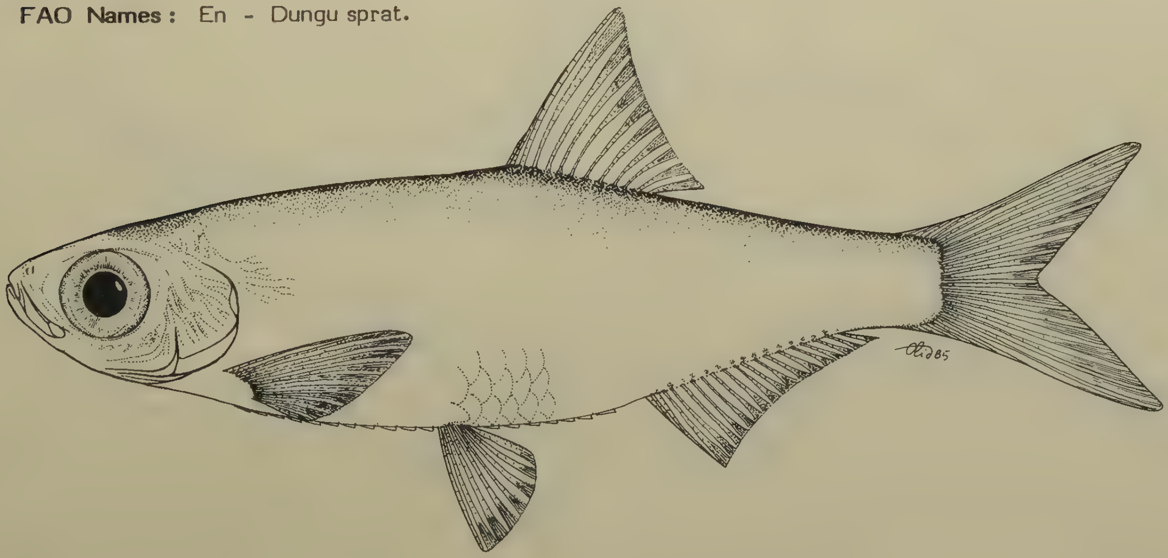
M. minuta Poll, 1974, West Africa, freshwaters
M. royauxi Boulenger, 1902, West Africa, freshwaters
Microthrissa Species A, West Africa, freshwaters.

Microthrissa minuta Poll, 1974

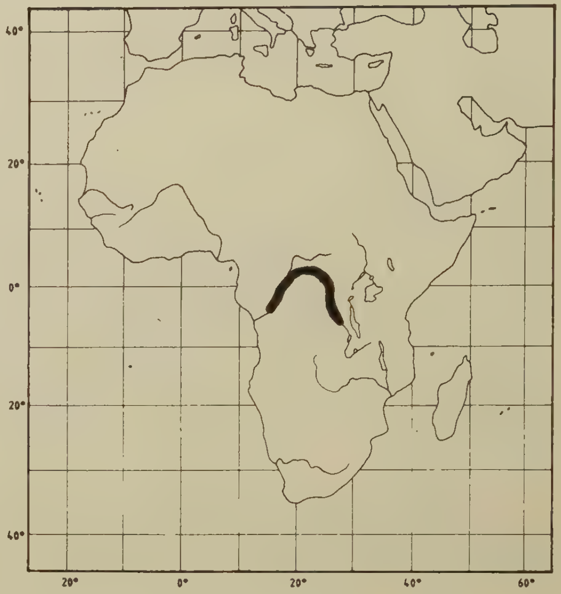
Microthrissa minuta Poll, 1974, Bull.Cl.Sci.Acad.r.Belge, (5)**60**(2):154, fig. 2, map 2 (Garamba River and Dungu River at Gangala na Bodio, upper Zaire system).

Synonyms: None.

FAO Names: En - Dungu sprat.



Diagnostic Features : Body moderately deep (depth about 22 to 30% of standard length). Scutes strongly keeled, 1 or 2 before base of first pectoral finray, 11 or 12 + 8. Snout pointed. Lower jaw not projecting, included in upper when mouth closed, with small teeth at symphysis; maxilla blade slender, more than 3 times as long as deep, upper edge with a ridge flared outward; second supra-maxilla small, shaft as long as blade, the latter spatulate. Lower gillrakers 19 to 21. Total anal finrays 18 to 21. Scales in lateral series 37 to 40. Resembles M. royauxi, which has fewer gillrakers but more anal finrays (14 to 16 and 23 to 27), and Microthrissa sp. A which lacks scutes before the pectoral fin base. Species of Poecilothrissa have larger scales (only 27 to 34 in lateral series) and are more slender (depth 20 to 24% of standard length); species of Potamothrissa have teeth at the sides of the lower jaw and almost no shaft to the second supra-maxilla.



Geographical Distribution : West African freshwaters (upper Zaire system in Dungu River and its tributary the Garamba River; also lower Zaire).

Habitat and Biology : Riverine. More data and specimens needed.

Size : To 3.5 cm standard length.

Interest to Fisheries : -

Local Names : -

Literature : Only Roberts & Stewart (1976) have mentioned the species since its original description in 1976 (see CLOFFA, 1984:46).

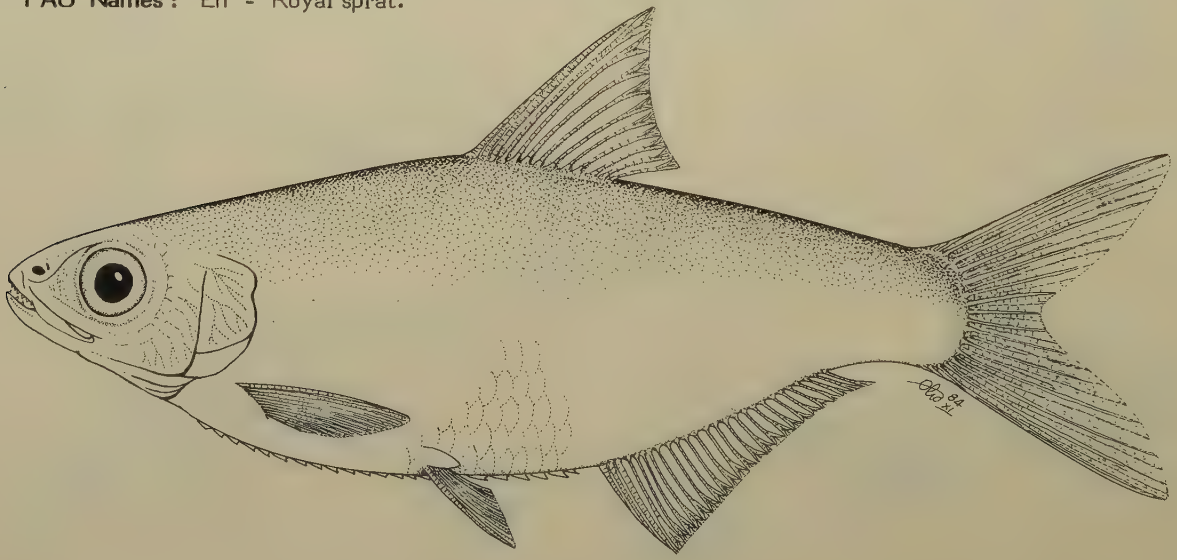
Microthrissa royauxi Boulenger, 1902

CLUP Micro 2

Microthrissa royauxi Boulenger, 1902, Ann.Congo Mus., Zool., 2:26, pl. 8, fig. 1 (Oubangui, Zaire system).

Synonyms : Pellonula (Microthrissa) royauxi:Poll, 1933:115; Microthrissa royauxi:Poll, 1974:147-148 (synopsis); CLOFFA, 1984:46 (full synonymy, distribution).

FAO Names : En - Royal sprat.



Diagnostic Features : Body rather deep (depth about 30 to 37% of standard length). Scutes strongly keeled, 1 or 2 before base of first pectoral finray, 13 or 14 + 6 or 7. Snout fairly pointed. Lower jaw not projecting, included in upper when mouth closed, with small teeth at symphysis; maxilla blade slender, more than 3 times as long as deep, upper edge with a ridge flared outward; second supra-maxilla small, shaft as long as or longer than blade, the latter spatulate. Lower gillrakers 14 to 16. Total anal finrays 23 to 27. Scales in lateral series 36 to 40. Resembles *M. minuta*, which has more gillrakers but fewer anal finrays (19 to 21 and 18 to 21), and *Microthrissa* Species A., which lacks scutes before the pectoral fin base. Species of *Poecilothrissa* and *Potamothrissa* are more slender, the latter also with teeth at the sides of the lower jaw and almost no shaft to the second supra-maxilla. *Pellonula vorax* has a deep maxilla blade (depth less than 3 times in length) and the second supra-maxilla paddle-shaped.

Geographical Distribution : West African freshwaters (most of Congo/Zaire system, including Oubangui River but apparently not in the Kasai and its tributaries).

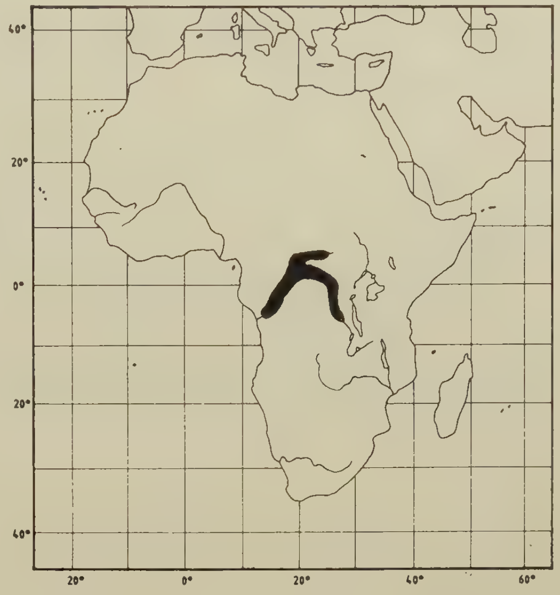
Habitat and Biology : Riverine (see Gosse, 1963).

Size : To 8 cm standard length.

Interest to Fisheries : A small contribution to local riverine catches.

Local Names : -

Literature : Twenty-six references to the species in CLOFFA (1984:46-47).



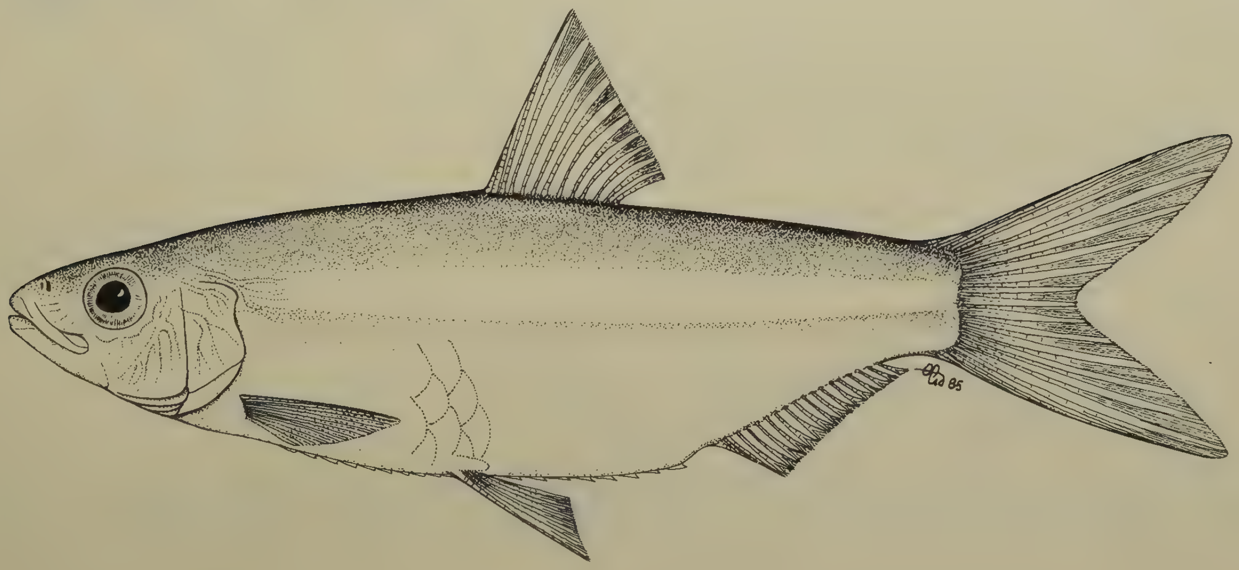
Microthrissa Species A

CLUP Micro 3

(AWAITING DESCRIPTION AND NAME)

Synonyms : None (but perhaps reported as *Pellonula* sp.).

FAO Names : En - Muffin sprat.



Diagnostic Features : Body moderately deep (depth 29 to 32% of standard length). Scutes moderately keeled before pelvic fin base, strongly keeled behind; no scutes before pectoral fin base, 9 or 10 + 8 or 9. Snout pointed. Lower jaw not projecting, included in upper when mouth closed, with small teeth at symphysis; maxilla slender, a little over 3 times as long as deep, upper edge with a sharp ridge slightly flared outward; second supra-maxilla small, shaft about as long as blade, the latter spatulate. Lower gillrakers 21 to 23. Total anal finrays 18 to 20. Scales in lateral series 35 to 37. Resembles M. royauxi and M. minuta, but no pre-prectoral scutes (also, only 14 to 16 gillrakers in M. royauxi). Species of Poecilothrissa have larger scales (only 27 to 34 in lateral series) and are more slender (depth 20 to 24% of standard length); species of Potamothrissa have teeth at the sides of the lower jaw and almost no shaft to the second supra-maxilla. Pellonula vorax and P. leonensis have a deep maxilla blade (depth less than 3 times in length) and the second supra-maxilla paddle-shaped.

Geographical Distribution : West African freshwaters (only known from the Birrim River near Kade, Ghana).

Habitat and Biology : Riverine. More data needed.

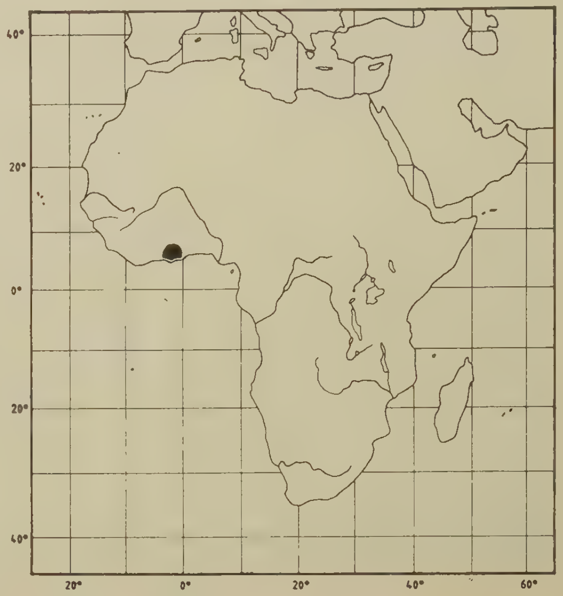
Size : To 7.3 cm standard length.

Interest to Fisheries : Probably contributes a little to riverine catches.

Local Names : -

Literature : -

Remarks : This represents a considerable extension in the range of Microthrissa, being the first record outside the Congo/Zaire system.

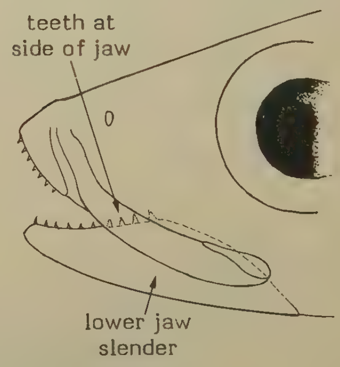


Potamothrissa Regan, 1917

CLUP Potamo

Potamothrissa Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:203 (type: Pellonula obtusirostris Boulenger).

Diagnostic Features : Small pellonulines, reaching about 7 cm (usually about 5 cm). Belly with a moderate keel of scutes beginning behind the pectoral fin base, or a strong keel beginning before it. Lower jaw not prominent, not rising steeply within mouth, teeth at symphysis continued back on either side of jaw; pre-maxillae with a single row of moderate teeth; maxilla blade slender, toothless, its depth more than 3 times in its length, its upper edge with a distinct flange against which the lower edge of the antorbital curves outward; second supra-maxilla small, with a short or vestigial anterior shaft. Lower gillrakers 14 to 18. Pelvic finrays i 7, its insertion slightly behind origin of dorsal fin. Scales small, 36 to 42 in lateral series. Differs from all other West African pellonulines in having a slender lower jaw with saw-like teeth reaching back on each side (similar but minute teeth occur in Limnothrissa miodon of Lake Tanganyika, but the lower jaw is normal, i.e. deep).



Biology, Habitat and Distribution : Freshwater, in West African rivers (Congo/Zaire system).

Interest to Fisheries : Little or none.

Species : In the review by Poll (1974), 3 fairly distinctive species were recognized:

P. acutirostris (Boulenger, 1899), West African freshwaters
P. obtusirostris (Boulenger, 1909), West African freshwaters
P. whiteheadi Poll, 1974, West African freshwaters.

Remarks : The presence of teeth at the side of the lower jaw is highly unusual in clupeid fishes. Such teeth also occur in the southeast Asian freshwater genus Clupeichthys (but lower jaw deep). As noted above, similar but much smaller teeth occur in the African genus Limnothrissa (jaw deep).

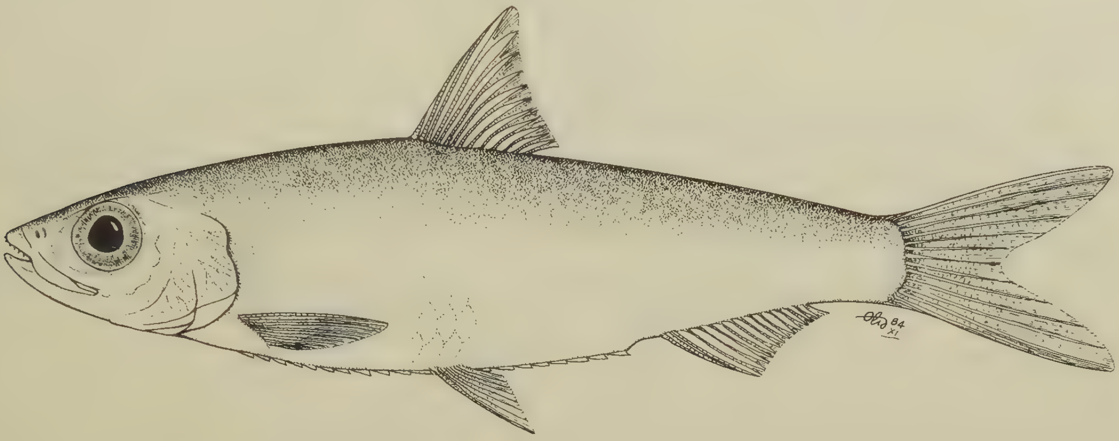
Potamothrissa acutirostris (Boulenger, 1899)

CLUP Potamo 1

Pellonula acutirostris Boulenger, 1899, Annls Mus.r.Congo Belge, 1:63, pls 35, fig. 7 (Coqulhatville = Mbandaka, Zaire system).

Synonyms : Pellonula acutirostris:Boulenger, 1909:159, fig. 127 (Zaire, Oubangui); Potamothrissa acutirostris - Regan, 1917:203 (upper Zaire River); Microthrissa acutirostris:Poll, 1948:21; Poll, 1974:148 (synopsis); CLOFFA, 1984:51 (complete synonymy, ref. to habitat).

FAO Names : En - Sharpnosed sawtooth pellonuline.



Diagnostic Features : Body slender (depth 19 to 27% of standard length). Pre-pelvic scutes fairly strongly keeled, beginning under or just before pectoral fin base, 11 to 13 + 10 to 12. Snout pointed. Lower jaw not projecting, included in upper when mouth closed, deepest at mid-point of jaw, with small saw-like teeth on either side; pre-maxillae with rather peg-like teeth, those near mid-line pointing forward; maxilla very slender, its blade over 3 times as long as deep, upper edge ridged (flared outward), lower edge without denticulations; second supra-maxilla very small, spatulate, its shaft about as long as its blade. Lower gillrakers 16 to 18. Differs from P. obtusirostris and P. whiteheadi in its pointed snout, also more gillrakers (cf. 14 to 16 and 14 to 17). Other pellonulines lack saw-like teeth at the sides of the lower jaw.

Geographical Distribution : West African freshwaters (most of Zaire system up River from Brazaaville, including the Oubangui, Lualaba, Kasai and other tributaries).

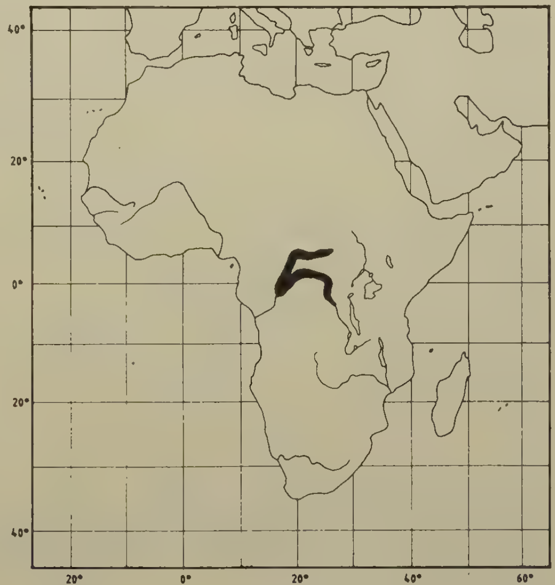
Habitat and Biology : Rivers and lakes, apparently in both running and still water; the distribution of the species suggests that it tolerates a wide variety of water conditions.

Size : To 7 cm standard length.

Interest to Fisheries : Probably little or none.

Local Names : -

Literature : Twenty-seven references to the species in CLOFFA (1984).



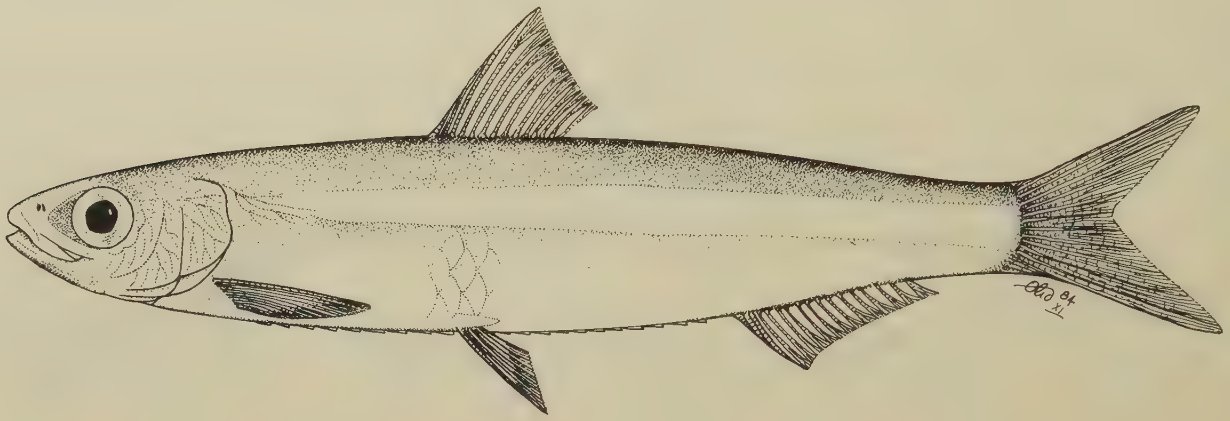
Potamothrissa obtusirostris (Boulenger, 1909)

CLUP Potamo 2

Pellonula obtusirostris Boulenger, 1909, Cat.Afr.f.-w.fishes, 1:158 (Aruwimi River, upper Zair system).

Synonyms : Pellonula tenuis Nichols & Griscom, 1917:675, fig. 3 (Stanleyville = Kisangani); Stolothrissa tembessensis Fowler, 1949:239, figs 5-8 (Oka, Zaire system); Potamothrissa obtusirostris - Regan, 1917:203, fig. 2 (Boulenger's types); Poll, 1974:148, map 3 (synopsis); CLOFFA, 1984:51 (complete synonymy, refs to habitat, food).

FAO Names : En - Bluntnosed sawtooth pellonuline.



Diagnostic Features : Body slender (18 to 27% of standard length). Pre-pelvic scutes not strongly keeled, beginning under or behind base of last pectoral finray, 7 to 10 + 10 to 12, belly rounded. Snout bluntly rounded. Lower jaw not projecting, exactly meeting tip of upper when mouth closed, deepest at mid-point of jaw, with small saw-like teeth on each side; pre-maxillae with small teeth pointing downward; maxilla very slender, its blade over 3 times as long as deep, upper edge ridged (flared outward), lower edge without denticulations; second supra-maxilla very small, spatulate, its shaft about as long as its blade. Lower gillrakers 14 to 16. Silver stripe on flank, narrower anteriorly. Differs from P. whiteheadi in having a distinct shaft to the second supra-maxilla and lacking dermal denticles on the snout, and from P. acutirostris in its blunt snout and fewer gillrakers (cf. 16 to 18). Other pellonulines lack saw-like teeth at the sides of the lower jaw.

Geographical Distribution : West African freshwaters (upper parts of Zaire system, i.e. northern and eastern tributaries).

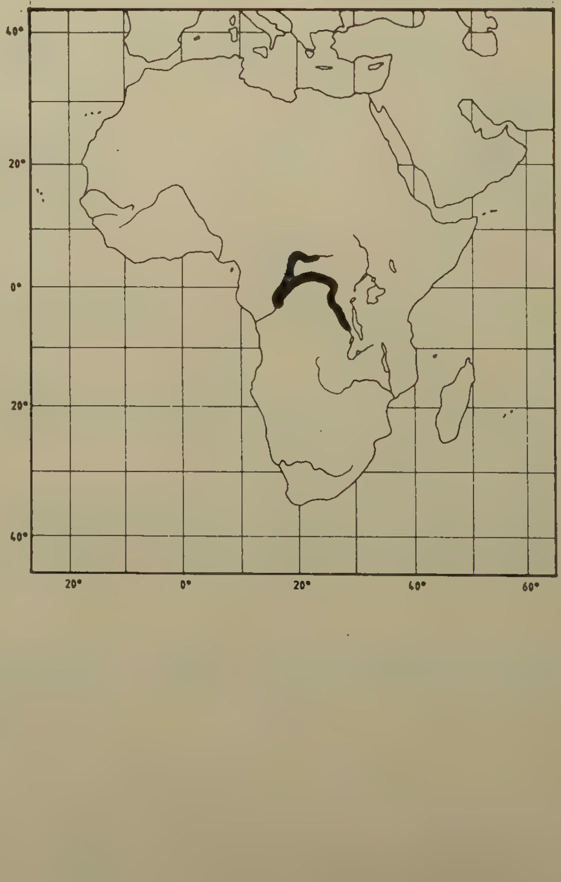
Habitat and Biology : Rivers and streams, perhaps not in lakes; feeds on aquatic insects (e.g. chironomid larvae) also hydracarians (Matthes, 1964:21). More data needed.

Size : To about 6 cm standard length.

Interest to Fisheries : Probably little or none.

Local Names : ZAIRE: Isandja.

Literature : Twenty-six references to the species in CLOFFA (1984).



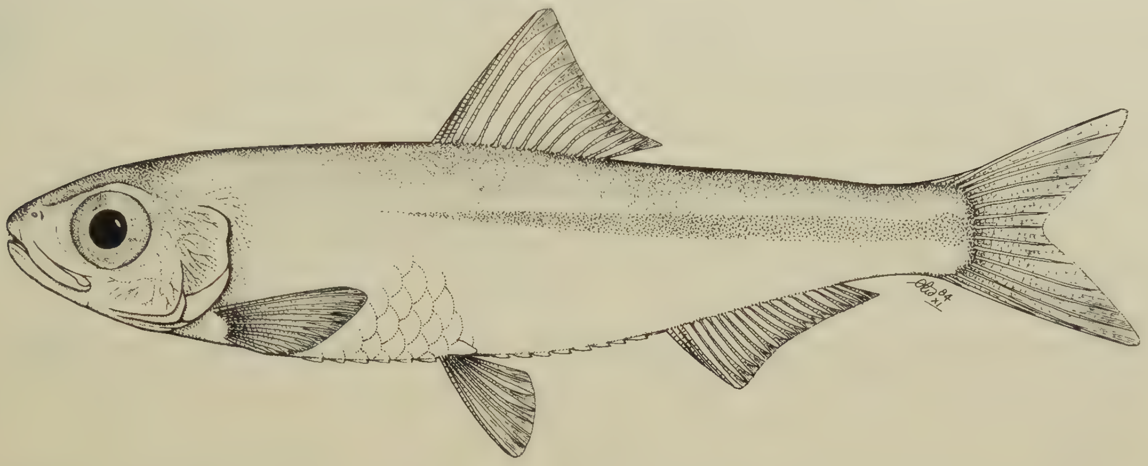
Potamothrissa whiteheadi Poll, 1974

CLUP Potamo 3

Potamothrissa whiteheadi Poll, 1974, Bull.Acad.r.Belg.Cl.Sci., (5)**60**:156, fig. 3, map 3 (Hombo River, eastern part of Zaire system).

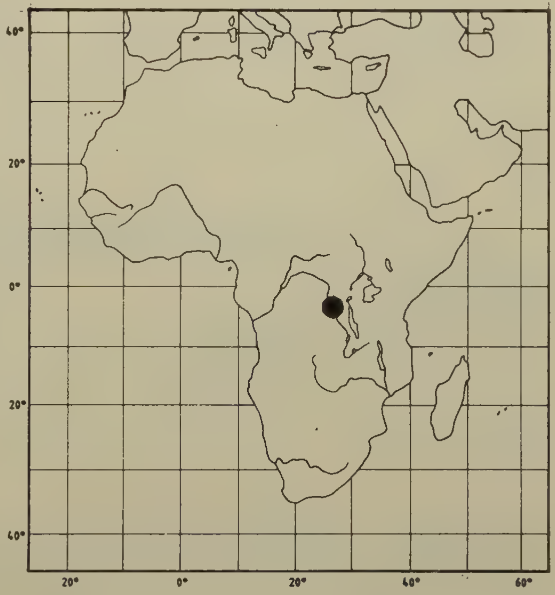
Synonyms : Potamothrissa whiteheadi - CLOFFA, 1984:52.

FAO Names : En - Whitehead's sawtooth pellonuline.



Diagnostic Features : Body slender (depth 22 to 25% of standard length). Pre-pelvic scutes not strongly keeled, beginning under or behind base of last pectoral finray, 8 to 10 + 7 to 9, belly rounded. Snout bluntly rounded. Lower jaw not projecting, exactly meeting tip of upper jaw when mouth closed, deepest at mid-point of jaw, with small saw-like teeth on each side; pre-maxillae with small teeth pointing downward; maxilla very slender, its blade over 3 times as long as deep, upper edge ridged (flared outward), lower edge without denticulations; second supra-maxilla minute, virtually without anterior shaft. Small dermal denticles on snout and border of mouth. Lower gillrakers 14 to 17. Silver stripe along flank, narrower anteriorly. Closely resembles P. obtusirostris, which lacks dermal denticles on the snout and has more post-pelvic scutes (10 to 12); P. acutirostris has a pointed snout and more gillrakers (16 to 18). Other pellonulines lack saw-like teeth at the sides of the lower jaw.

Geographical Distribution : West African freshwaters (Hombo River, affluent of Luhoho River, about 1°30'S 28°30'E, Zaire system).



Habitat and Biology : Riverine, but no other data.

Size : To 4.7 cm standard length.

Interest to Fisheries : Probably none.

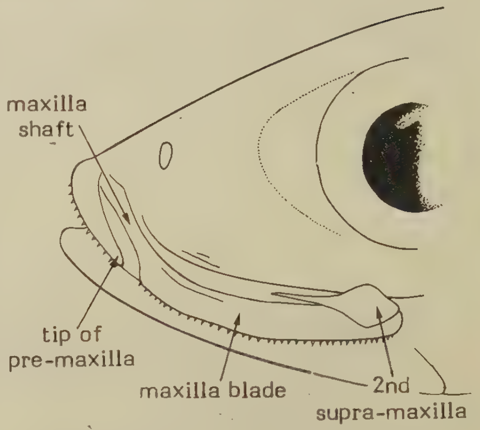
Local Names : -

Literature : Apparently not mentioned since its description in 1974.

Stolothrissa Regan, 1917

CLUP Stolo

Stolothrissa Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:206 (type: Stolothrissa tanganicae Regan).



Diagnostic Features : Small or moderate pellonulines, reaching about 8.5 cm, known only from Lake Tanganyika. Belly rather rounded, pre-pelvic scutes not strongly keeled, but post-pelvic scutes with sharp spines. Lower jaw very slightly protruding when mouth closed, rising steeply within mouth, teeth small; pre-maxillae with very small teeth; maxilla blade long, more than twice length of its shaft, its upper edge with a distinct flange; second supra-maxilla somewhat paddle-shaped, as deep as maxilla blade. Lower gillrakers long, slender and numerous. Pelvic finrays i 7, its insertion below first third of dorsal fin base. Scales small, 36 to 46 in lateral series. Resembles Limnothrissa, which has an even longer maxilla blade (to tip of pre-maxilla) and lower part of second supra-maxilla much deeper than upper. All other West African pellonulines have the maxilla blade only a little longer than its shaft.

Biology, Habitat and Distribution : Freshwater, in one central African lake (Lake Tanganyika).

Interest to Fisheries : Of considerable local commercial importance and far more abundant than Limnothrissa; combined catches were 65 129 tons in 1983.

Species : A single species recognized:

S. tanganicae Regan, 1917, central African freshwaters.

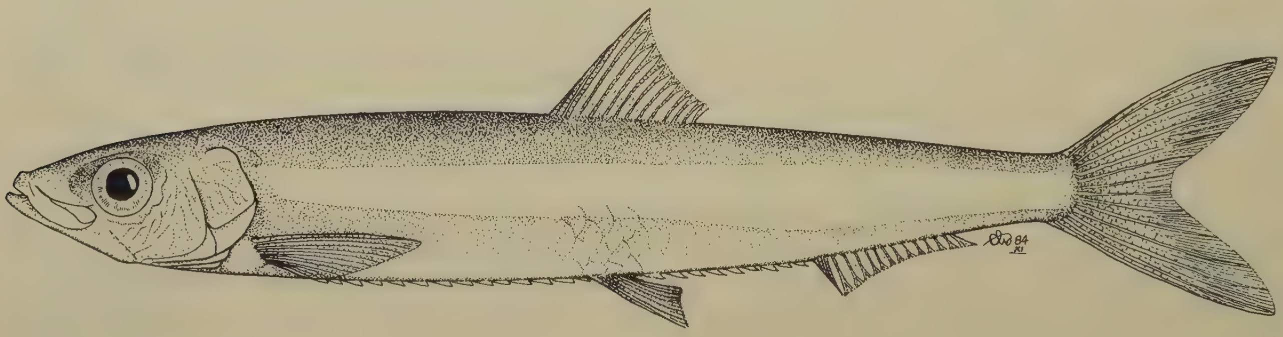
Stolothrissa tanganicae Regan, 1917

CLUP Stolo 1

Stolothrissa tanganicae Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:206, fig. 2 (2) (Lake Tanganyika).

Synonyms : Pellonula miodon:Boulenger, 1906:546 (some of his specimens, the rest Limnothrissa miodon); Boulenger, 1909:157 (same); Stolothrissa tanganicae - Poll, 1974:149, map 3 (synopsis); CLOFFA, 1984:54 (complete synonymy, refs to habitat, food breeding, population biology, growth, migrations, fisheries).

FAO Names : En - Lake Tanganyika sprat.



Diagnostic Features : Body slender (depth about 17 to 22% of standard length). Pre-pelvic scutes not strongly keeled, beginning behind base of last pectoral finray. Maxilla blade about 2 1/4 times as long as its shaft, but not continued forward to hind tip of pre-maxilla; second supra-maxilla diamond-shaped or more or less rhomboidal, approximately symmetrical. Lower gillrakers long and slender, 36 to 42. A distinct silver stripe along flanks, broadest over tips of pelvic fins. Resembles Limnothrissa miodon of Lake Tanganyika, which is slightly deeper-bodied, has a larger eye (about equal to length of head behind eye) and a maxilla blade continued forward to hind tip of pre-maxilla.

Geographical Distribution : One central African lake (Lake Tanganyika).

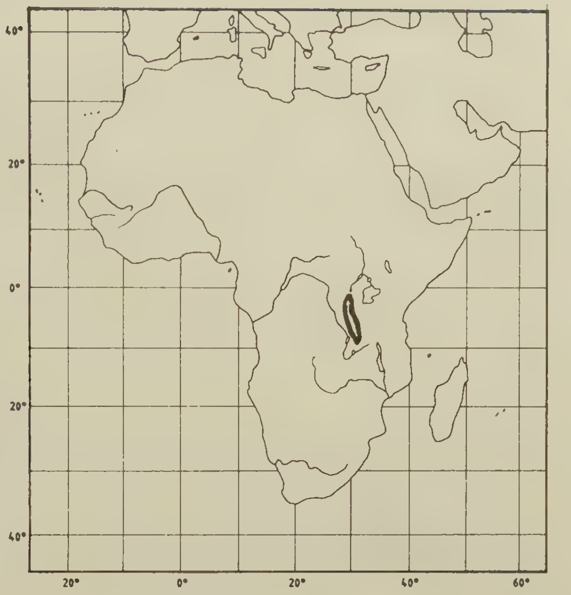
Habitat and Biology : Lacustrine, forming very large schools, the juveniles tending to stay closer to the shore than those of 5 cm standard length or more; appear to spend daylight hours below about 60 m, rising up to 8 to 15 m at night, especially on dark nights. Feeds on plankton (prawns, shrimps, also copepods, chironomids, diatoms and algae). Breeds at about 6 cm standard length, with ripe individuals present almost throughout the year, but major spawning in May/June and again in December/January, the adults moving inshore to breed. The eggs sink slowly.

Size : To about 8.5 cm standard length, usually about 7 cm.

Interest to Fisheries : The more abundant of the two Lake Tanganyika clupeids, but catch statistics combined with those for Limnothrissa miodon to total 65 129 tons in 1983. Caught with seine nets, often using lights.

Local Names : Ndakala, Dagaa (Lake Tanganyika).

Literature : Fifty-six references to the species in CLOFFA (1984).

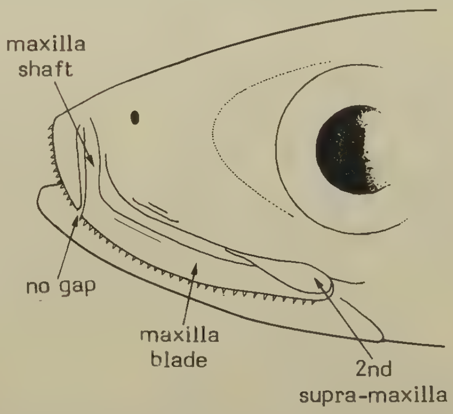


Limnothrissa Regan, 1917

CLUP Limno

Limnothrissa Regan, 1917, Ann.Mag.nat.Hist., (8)19:207 (type: Pellonula miodon Boulenger, in part).

Diagnostic Features : Small or fairly large pellonulines, one species reaching about 13 cm, known only from Lake Tanganyika and Lake Mweru. Belly rather rounded, pre-pelvic scutes not strongly keeled, but post-pelvic scutes with sharp spines. Lower jaw very slightly protruding when mouth closed, rising steeply within mouth, with minute teeth at sides (not saw-like, however); pre-maxillae with very small teeth; maxilla blade very long, more than four times length of its shaft, its upper edge with a slight ridge, its lower edged toothed and meeting tip of pre-maxilla; second supra-maxilla paddle-shaped, lower part larger than upper, not quite as deep as maxilla blade. Lower gillrakers long, slender and in one species numerous. Pelvic finrays i 7, its insertion below first third of dorsal fin base. Scales small, 40 or more in lateral series. Resembles Stolothrissa of Lake Tanganyika, which has a shorter maxilla blade (not reaching forward to tip of pre-maxilla) and a more symmetrical second supra-maxilla. All other West African pellonulines have the maxilla blade only a little longer than its shaft.



Biology, Habitat and Distribution : Freshwater, in two central African lakes (Lake Tanganyika, Lake Mweru); introduced into other lakes.

Interest to Fisheries : Of some local commercial importance in Lake Tanganyika and with potential value when introduced into other lakes. Catches of this species and the more abundant Stolothrissa in 1983 were 65 129 tons.

Species : Long believed monotypic, but a second species was subsequently discovered in Lake Mweru:

L. miodon (Boulenger, 1906), central African freshwaters
L. stappersii (Poll, 1948), central African freshwaters.

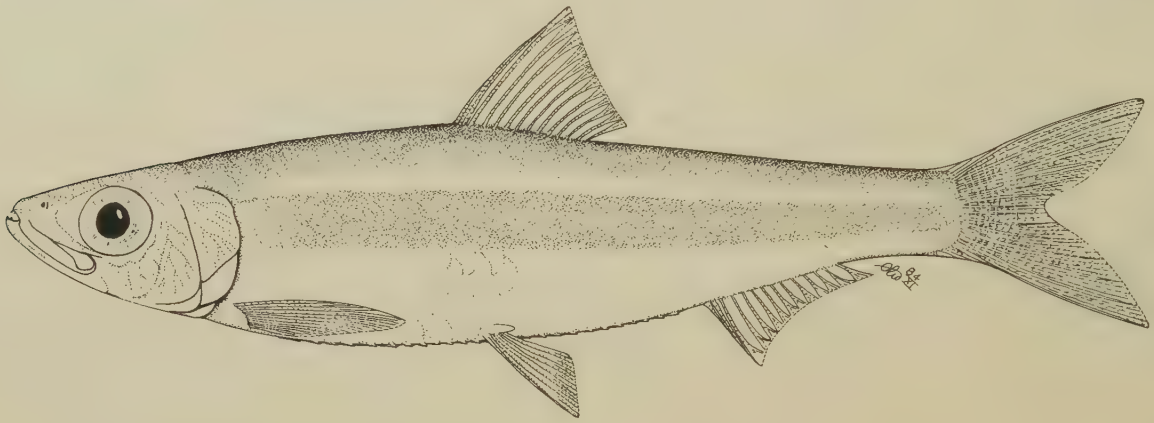
Limnothrissa miodon (Boulenger, 1906)

CLUP Limno 1

Pellonula miodon Boulenger, 1906, Trans.zool.Soc.Lond., **17**(6):546, pl. 30, fig. 2 (Lake Tanganyika; but some specimens were Stolothrissa tanganicae Regan).

Synonyms : Pellonula miodon:Boulenger, 1909:157, fig. 125 (but some specimens S. tanganicae); Limnothrissa miodon - Regan, 1917:207, fig. 2(1) (Lake Tanganyika); Poll, 1974:149, map 2 (synopsis); CLOFFA, 1984:45 (complete synonymy, refs to habits, food, breeding, growth, behaviour, migrations, fisheries).

FAO Names : En - Lake Tanganyika sardine.



Diagnostic Features : Body fairly slender (depth about 22 to 24% of standard length). Pre-pelvic scutes not strongly keeled, beginning behind base of last pectoral finray. Maxilla blade over 4 times as long as its shaft, its lower toothed edge continued forward to meet hind tip of pre-maxilla; second supra-maxilla asymmetrical, lower half larger. Lower gillrakers long and slender, 35 to 38. A distinct silver stripe along flank. Resembles Stolothrissa tanganicae of Lake Tanganyika, which is more slender, has a small eye (less than head behind eye) and a shorter maxilla blade not reaching forward to hind tip of pre-maxilla. Distinguished from its congener in Lake Mweru, Limnothrissa stappersii, chiefly by having more gillrakers (cf. only 22 to 25).

Geographical Distribution : One central African lake (Lake Tanganyika), but introduced into several other lakes (Lake Kivu, Lake Kariba, Cahora Bassa reservoir).

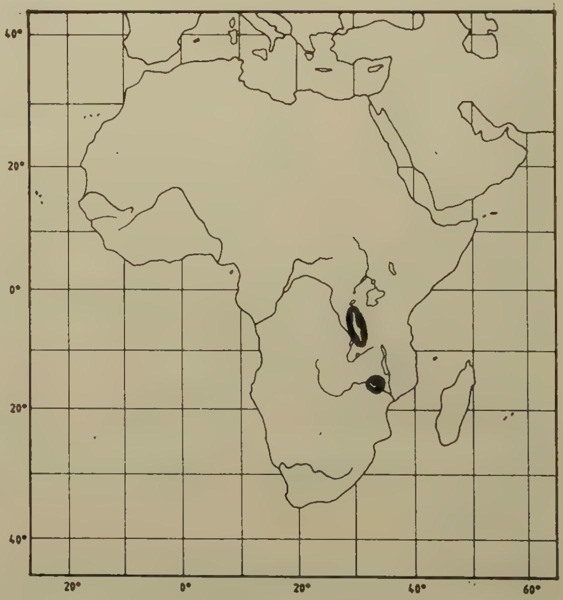
Habitat and Biology : Lacustrine, forming large schools. Feeds on plankton (especially atyid shrimps, also copepods, prawns, etc.), but larger individuals apparently take larval Stolothrissa. Breeds close to the shore throughout the rainy seasons, but with peaks in May/June and December/January.

Size : To about 13 cm standard length.

Interest to Fisheries : Of less importance than Stolothrissa tanganicae in Lake Tanganyika, although reaching a slightly larger size. Catch statistics combine the two species, with a total of 65 129 tons in 1983. Introduced into Lake Kariba, it may support a moderate but locally valuable fishery.

Local Names : Dagaa (Lake Tanganyika), Kapenta (Lake Kariba).

Literature : Sixty-four references to the species in CLOFFA (1984).



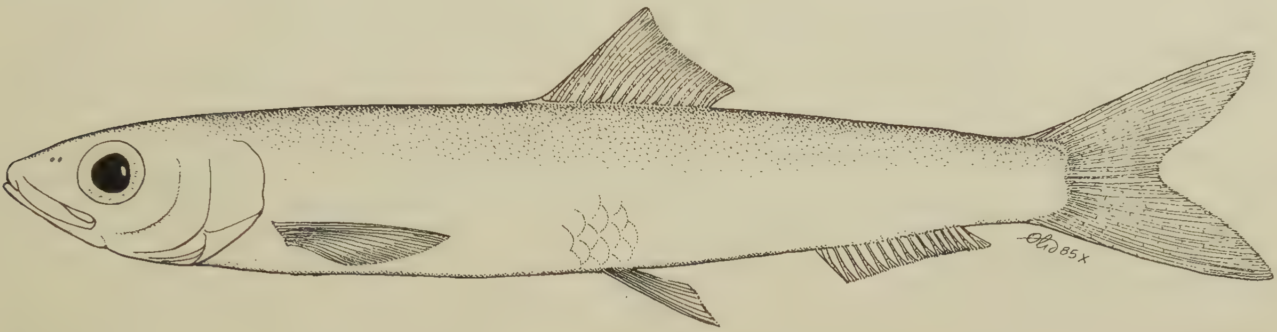
Limnothrissa stappersii (Poll, 1948)

CLUP Limno 2

Microthrissa (*Potamothrissa*) *stappersii* Poll, 1948, *Bull.Mus.r.Hist.nat.Belg.*, (24)**21**:17, fig. 7 (Lake Mweru at Lukonzolwa).

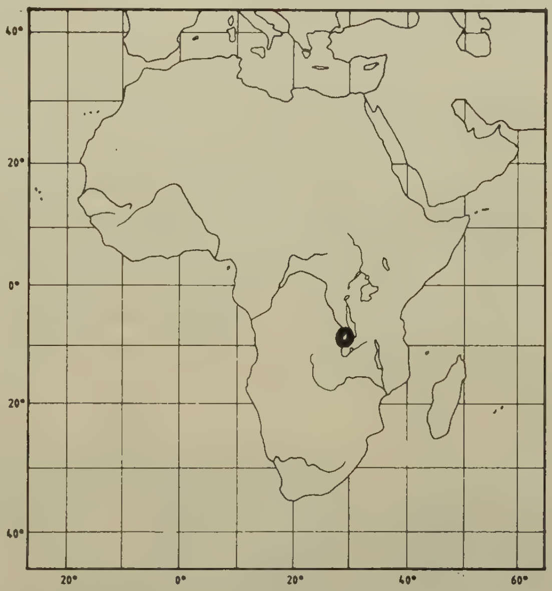
Synonyms : *Limnothrissa stappersii* - Poll, 1974:149, map 2 (synopsis, misspelt as *stappersi*); CLOFFA, 1984:46 (complete synonymy).

FAO Names : En - Stapper's sprat.



Diagnostic Features : Known only from small and perhaps juvenile specimens of 2.8 cm total length, but appears similar to *L. miodon* of Lake Tanganyika except for fewer lower gillrakers (22 to 25; cf. 35 to 38), fewer anal finrays (15 to 17; cf. 17 to 18) and absence of scutes (a juvenile character ?).

Geographical Distribution : One central African lake (Lake Mweru).



Habitat and Biology : Lacustrine, apparently forming large schools. More data needed.

Size : Specimens of 2.8 cm total length (about 2.3 cm standard length) recorded, but perhaps grows larger.

Interest to Fisheries : Little or none.

Local Names : -

Literature : Six references to this species in CLOFFA (1984).

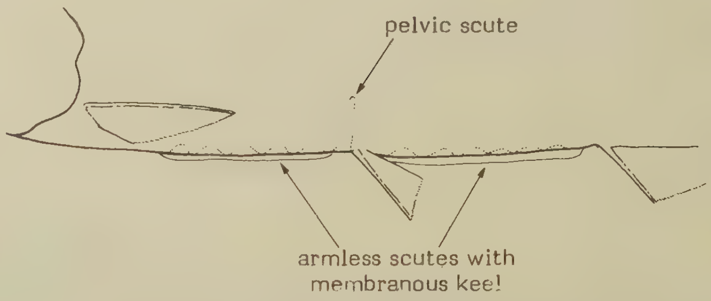
Remarks : Possibly this is merely the juvenile of *L. miodon*, although adult anal finray counts are usually fixed by about 2.5 cm standard length and scutes are visible.

Sierrathrissa Thys van den Audenaerde, 1969

CLUP Sierr

Sierrathrissa Thys van den Audenaerde, 1969, Rev.Zool.Bot.afr., 80(3-4):386 (type: Sierrathrissa leonensis Thys van den Audenaerde).

Diagnostic Features : Very small pellonulines, adult at 1.8 to 2 cm standard length. Scutes present before and behind pelvic fin base, without lateral arms (except for the pelvic scute itself), but bearing a low membranous keel. Jaws about equal, with small teeth; second supra-maxilla spatulate, with moderate anterior shaft. Lower gillrakers less than 20. Branchiostegal rays usually 3. Dorsal fin origin behind midpoint of body; pelvic fin insertion well before dorsal fin, with i 6 finrays; anal finrays 17 to 21, its origin below dorsal fin base. Scales apparently absent except near tail. Resembles juveniles of other pellonulines (especially Pellonula), but other genera have i 7 pelvic finrays, the pelvic fin insertion below or only a little before the dorsal fin base and 6 branchiostegal rays (except Thrattidion and Congothrissa with 3, but no second supra-maxilla).



Biology, Habitat and Distribution : Freshwater, in West African rivers from Senegal to Cameroon, also man-made lakes (Kainji and Volta).

Interest to Fisheries : Little or none.

Species : A single species recognized:

S. leonensis Thys van den Audenaerde, 1969, West African freshwaters.

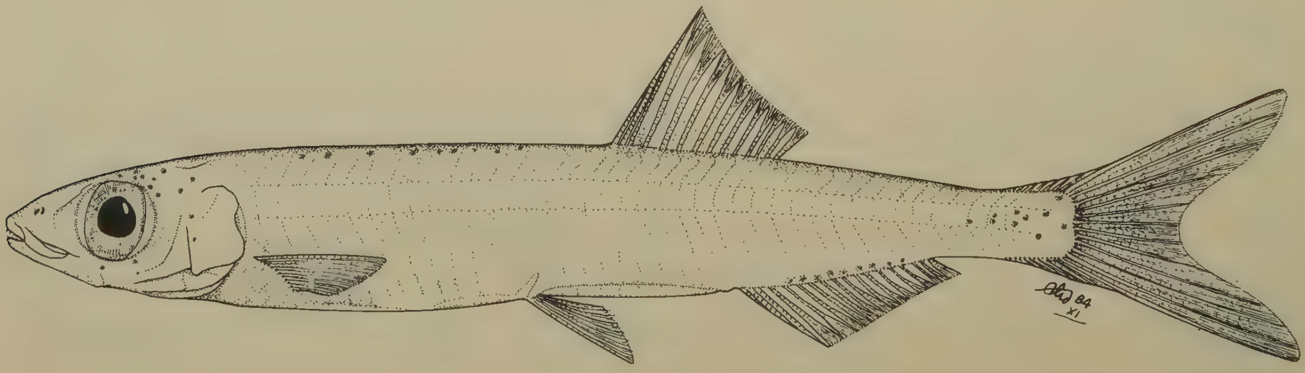
Sierrathrissa leonensis Thys van den Audenaerde, 1969

CLUP Sierr 1

Sierrathrissa leonensis Thys van den Audenaerde, 1969, Rev.Zool.Bot.afr., 80(3-4):386, figs 1,2 (Waanje ferry near Pujehun, Sierra Leone).

Synonyms : Pellonula afzeliusi: Johnels, 1954:351 (Gambia River, some of the smaller syntypes of afzeliusi); Microthrissa miri:Daget, 1954:67 (Bamako, Diafarable, upper Niger; some of the smaller paratypes); Potamothrissa miri:Turner, 1970:11 (some juveniles); Sierrathrissa leonensis - Poll, 1974:150 (synopsis); Teugels & Thys van den Audenaerde, 1979:523, figs 2,4,6,9 (comparison with Pellonula afzeliusi); CLOFFA, 1984:54 (complete synonymy); Whitehead & Teugels, 1985 (descr.distrib., osteology).

FAO Names : En - West African pygmy herring.



Diagnostic Features : Small, slender fishes, easily mistaken for the juveniles of Pellonula. Belly rounded, pre-pelvic scutes minute, 4 to 10, without arms, supporting a low membranous keel, post-pelvic scutes similar, the keel more apparent. Lower gillrakers 13 to 16. Pelvic insertion well before dorsal fin, with i 6 finrays; anal fin beginning under dorsal fin base. Commonly occurs with Pellonula, which has i 7 pelvic finrays, normal scutes and the pelvic fin insertion more or less below the dorsal fin origin.

Geographical Distribution : Rivers of West Africa (Senegal to Cameroon, apparently in both lower and upper reaches, but the latter only confirmed in the case of the Niger); also the man-made lakes Kainji (Nigeria) and Volta (Ghana).

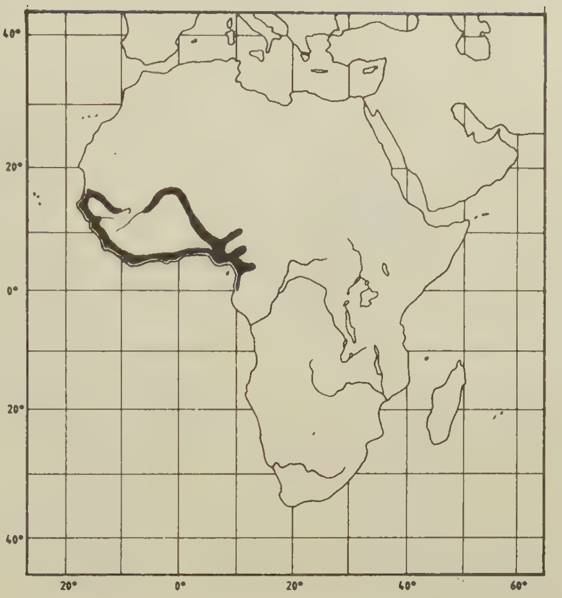
Habitat and Biology : Riverine, but also in man-made lakes, schooling in open waters and at about 2 to 8 m in Kainji Lake; rising to about 30 cm from the surface at night in Volta Lake. Feeds on plankton, especially cladocerans. Breeds at about 1.8 to 2 cm standard length, in Kainji Lake in February/March and October/November, but with ripe individuals occurring throughout the year.

Size : To 3 cm standard length, usually 2 to 2.5 cm.

Interest to Fisheries : Little or none.

Local Names : -

Literature : Fifteen references to this species in CLOFFA (1984); Whitehead & Teugels (1985 - synopsis of biol.; also anatomy).



Thrattidion Roberts, 1972

CLUP Thrat

Thrattidion Roberts, 1972, Breviora, (382):2 (type: Thrattidion noctivagus Roberts).

Diagnostic Features : Among the smallest of the pellonulines, not yet known to exceed 2.14 cm standard length. Scutes present before and behind pelvic fin base, with lateral arms, the pre-pelvic scutes unkeeled. Jaws about equal, with small teeth; no second supra-maxilla. Lower gillrakers few (at most 11). Branchiostegal rays 4 or 5. Pelvic fin with i 6 or 7 finrays, its insertion before dorsal fin origin; anal fin with 23 to 25 finrays, its origin below dorsal fin base. Scales present behind gill opening and on either side of belly. Resembles juveniles of other pellonulines, but all have a second supra-maxilla (except Congothrissa, which has no pre-pelvic or post-pelvic scutes and only 3 branchiostegal rays).

Biology, Habitat and Distribution : Freshwater, in at least one West African river (Sanaga, Cameroon).

Interest to Fisheries : –

Species : A single species recognized:

Thrattidion noctivagus Roberts, 1972, West African, freshwaters.

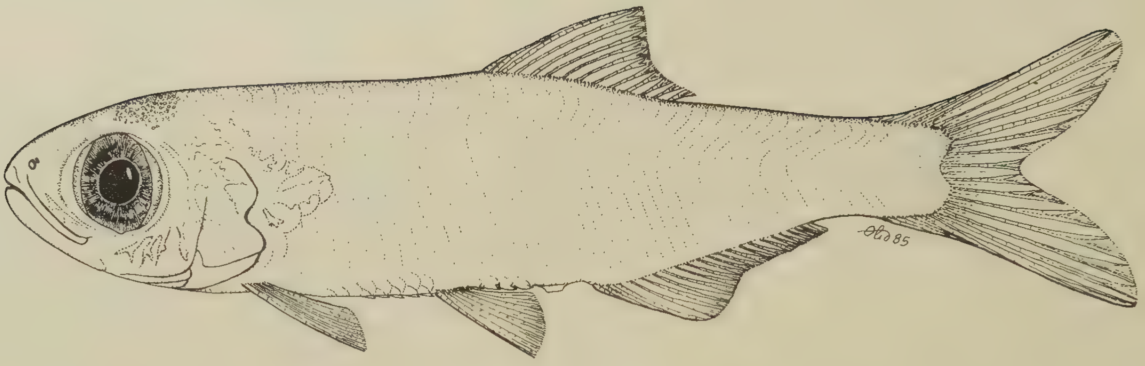
Thrattidion noctivagus Roberts, 1972

CLUP Thrat 1

Thrattidion noctivagus Roberts, 1972, Breviora, (382):4, figs 1-14 (Sanaga River at Edea, Cameroon).

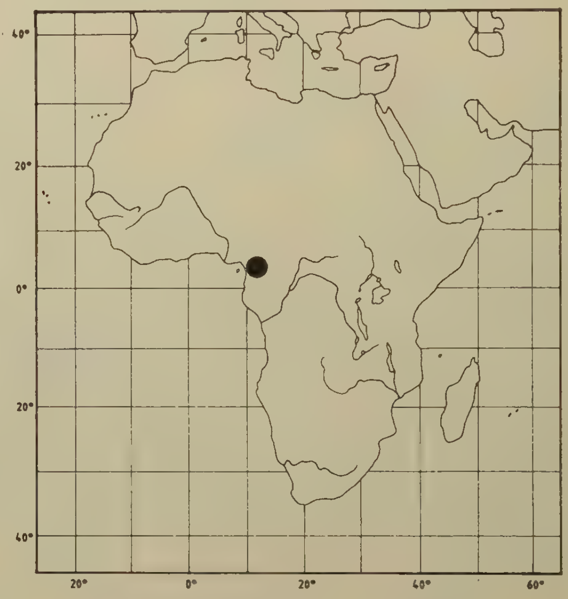
Synonyms : Thrattidion noctivagus - Poll, 1974:150 (synopsis); CLOFFA, 1984:55 (complete synonymy).

FAO Names : En - Sanaga pygmy herring.



Diagnostic Features : Small and slender or moderately deep-bodied fishes (depth 20 to 28% of standard length), perhaps not reaching much over 2 cm standard length. Belly rounded, pre-pelvic scutes 4 to 7, with lateral arms, but without keels; pelvic scute with 2 or 3 lateral arms (i.e. branched); post-pelvic scutes keeled and with arms. Lower gillrakers 10 or 11. Pelvic insertion well before dorsal fin, with i 6 or 7 finrays; anal fin beginning under dorsal fin base. The presence of scutes distinguishes it from Congothrissa gossei and the absence of a second supra-maxilla distinguishes it from all other West or central African pellonulines (even at 2 cm standard length).

Geographical Distribution : Only recorded from a single West African river (Sanaga at Edea).



Habitat and Biology : Riverine, collected only at dusk and dawn in swiftly flowing water of about 1 m just above the hydro-electric dam at Edea. Feeds on plankton and some terrestrial insects. No data on breeding; Roberts (1972) assumed his largest specimen (2.14 cm standard length) was mature.

Size : To 2.14 cm standard length.

Interest to Fisheries : -

Local Names : -

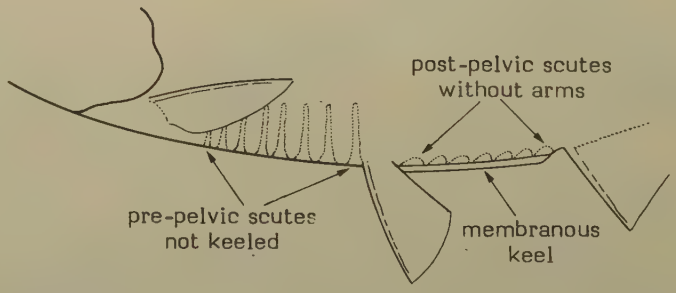
Literature : Subsequent references merely repeat the data of Roberts (1972).

Laeviscutella Poll, Whitehead & Hopson, 1965

CLUP Laev

Laeviscutella Poll, Whitehead & Hopson, 1965, Bull.Acad.r.Belg.Cl.Sci., (5)51(3):279 (type: Laeviscutella dekimpei Poll, Whitehead & Hopson).

Diagnostic Features : Small pellonulines reaching about 4 cm standard length. Scutes present before pelvic fin base, with lateral arms, but not keeled, those behind without arms, but supporting a low membranous keel. Lower jaw a little prominent, both jaws with small teeth; second supra-maxilla paddle-shaped. Lower gillrakers 21 to 26. Branchiostegal rays 6. Pelvic fin with i 7 finrays, its insertion below about dorsal fin origin; anal fin origin behind dorsal fin base. Scales present and visible on whole body. Distinguished from other pellonulines by its armed but unkeeled pre-pelvic scutes and armless post-pelvic scutes.



Biology, Habitat and Distribution : Freshwater, in West African rivers (Ivory Coast to Gabon).

Interest to Fisheries : Little or none.

Species : A single species recognized:

L. dekimpei Poll, Whitehead & Hopson, 1965, West African freshwaters.

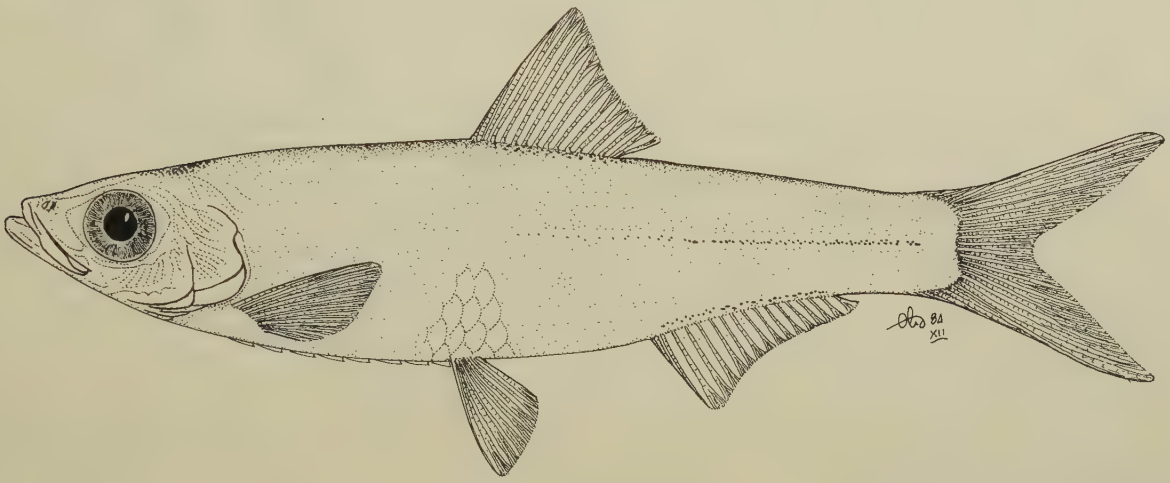
Laeviscutella dekimpei Poll, Whitehead & Hopson, 1965

CLUP Laevi 1

Laeviscutella dekimpei Poll, Whitehead & Hopson, 1965, *Bull.Acad.r.Belg.Cl.Sci.*, (5)**51**(3):280, figs 1-4 (Ghana near Tema, Nigeria near Lagos, Dahomey in Lake Nokoué, Gabon at Agilé and Congo in the Loumé River).

Synonyms : *Laeviscutella dekimpei* - Poll, 1974:150 (synopsis); CLOFFA, 1984:45 (complete synonymy).

FAO Names : En - Roundbelly pellonuline.



Diagnostic Features : Small and fairly slender fishes (depth 22 to 25% of standard length), probably not exceeding about 4 cm standard length. Belly rounded, pre-pelvic scutes 7 or 8, with lateral arms but without keels and hidden by scales; post-pelvic scutes without arms, but supporting a low membranous keel. Lower gillrakers 21 to 26. In all other West African pellonulines with scutes, the post-pelvic scutes have lateral arms, except *Sierrathrissa* (in which the pre-pelvic scutes also lack arms and the pelvic fin insertion is well before the dorsal fin origin).

Geographical Distribution : Lower parts of rivers of West Africa (Ivory Coast to Congo, perhaps also to Zaire), also lagoons (Lake Ebrié, Ivory Coast; Lake Nokué, Dahomey).

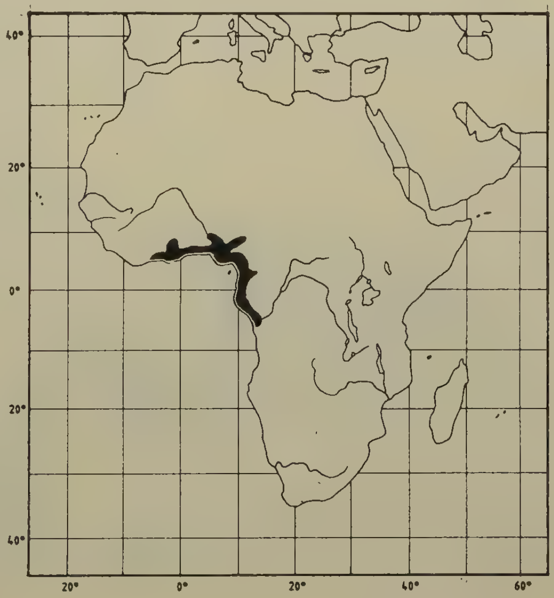
Habitat and Biology : Riverine, chiefly near the coast and entering lagoons, where salinities vary with the tides; the species is presumably euryhaline, although it may escape high salinities. No data on feeding. Ripe females of 3.5 to 4 cm standard length were recorded in Lake Ebrié by Daget & Iltis (1965:54).

Size : To just over 4 cm standard length.

Interest to Fisheries : Little or none.

Local Names : -

Literature : Only five references to this species found by CLOFFA (1984), adding little to the original description.

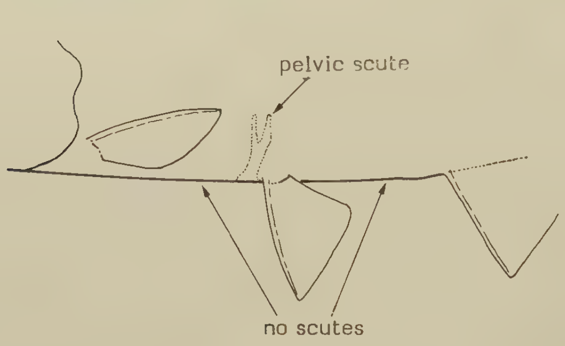


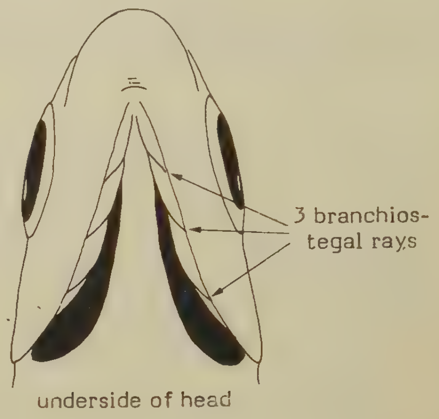
Congothrissa Poll, 1964

CLUP Congo

Congothrissa Poll, 1964, Bull.Acad.r.Sci.Outre-Mer Cl.Sci.nat.méd., NS 15(2):8 (type: Congothrissa gossei Poll).

Diagnostic Features : Unique among West African pellonulines in lacking pre-pelvic and post-pelvic scutes. Small fishes not exceeding about 3.5 cm standard length, with a reduced number of lower gillrakers (10 to 12) and branchiostegal rays (3 or 4) and the second supra-maxilla absent.





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Biology, Habitat and Distribution : Freshwater, in West Africa (Zaire system only).

Interest to Fisheries : Little or none.

Species : A single species recognized:

C. gossei Poll, 1964, West African freshwaters.

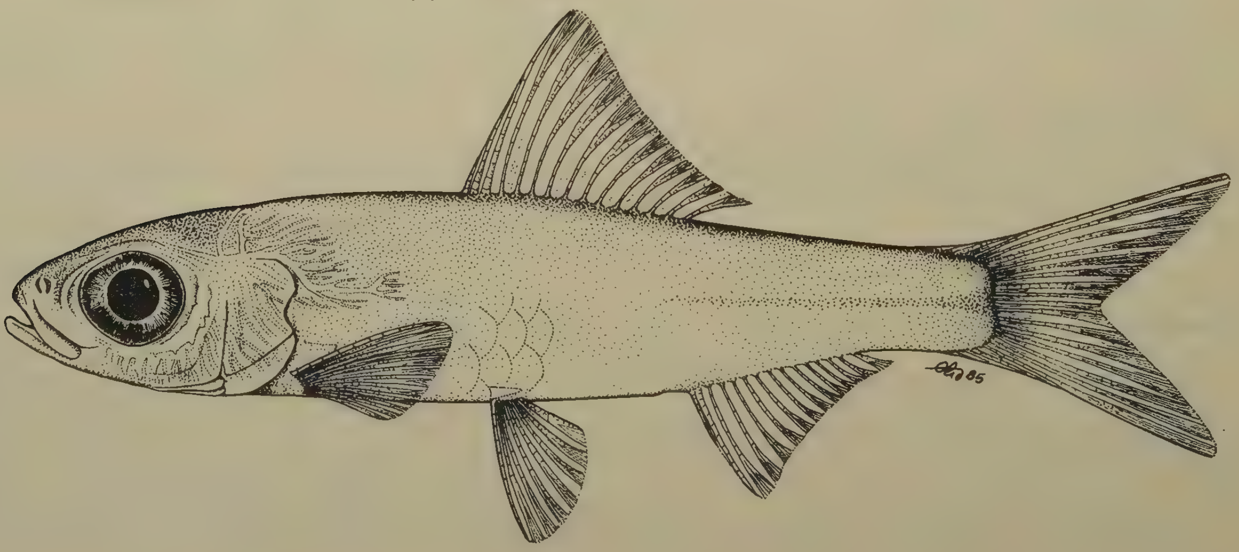
Congothrissa gossei Poll, 1964

CLUP Congo 1

Congothrissa gossei Poll, 1964, Bull.Acad.r.Sci.Outre-Mer Cl.Sci.nat.méd., NS 15(2):8 (Yangambi, near Yaekela, Zaire River).

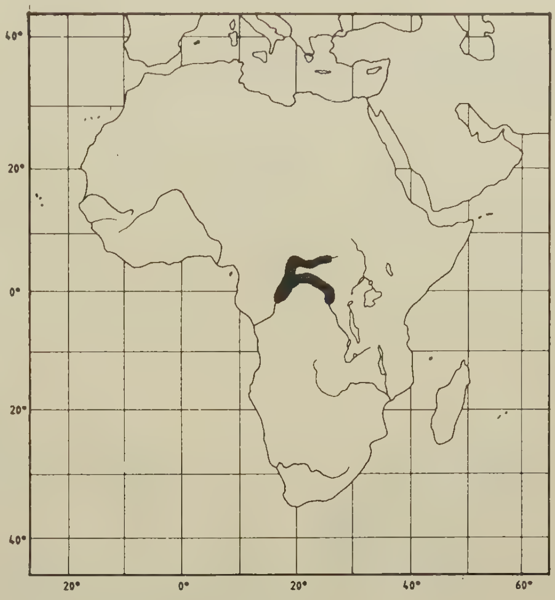
Synonyms : Congothrissa gossei - Poll, 1974:151 (synopsis); Poll & Teugels, 1984:56 (complete synonymy).

FAO Names : En - Smoothbelly pellonuline.



Diagnostic Features : Small, fairly slender fishes (depth around 22 to 24% of standard length), probably not exceeding 3.5 cm standard length. Belly rounded, smooth, no trace of scutes before or behind pelvic fins (pelvic scute itself present, however, the tips of its lateral arms bifurcated. Jaws about equal, with fine teeth; no second supra-maxilla. Lower gillrakers 10 to 12. Pelvic fin insertion just behind dorsal fin origin, with i 7 finrays. Scales large, about 22 in lateral series. Occurs with species of Microthrissa, Poecilothrissa, Potamothrissa, etc., but the smoothly rounded belly, absence of spiny post-pelvic scutes and lack of a second supra-maxilla makes it unmistakable.

Geographical Distribution : Central part of Zaire system (around Kisangani area and also Ubangui River at Bangui and upstream).



Habitat and Biology : Riverine, apparently in the main stream. Feeds on small shrimps, mosquito larvae and chironomid larvae (Poll, 1964). More data needed.

Size : To 3.5 cm standard length.

Interest to Fisheries : Little or none.

Local Names : -

Literature : Only seven references to this species in Poll & Teugels (1984).

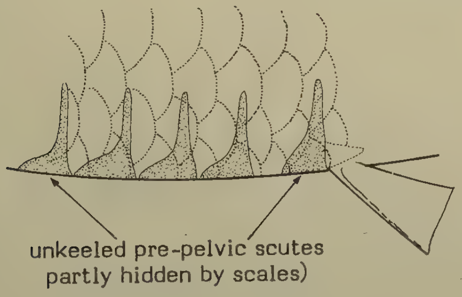
Remarks : Poll (1964) proposed a distinct family for this species, the Congothrissidae, and on additional anatomical grounds Taverne (1977) agreed and was followed by Poll & Teugels (1984). However, Congothrissa only carries pellonuline trends of reduction a stage further (scutes and second supra-maxilla now completely absent) and shows no characters that differ fundamentally from those of all other pellonulines; even the recognition of a separate tribe, the Congothrissini of Poll (1974), seems unnecessary.

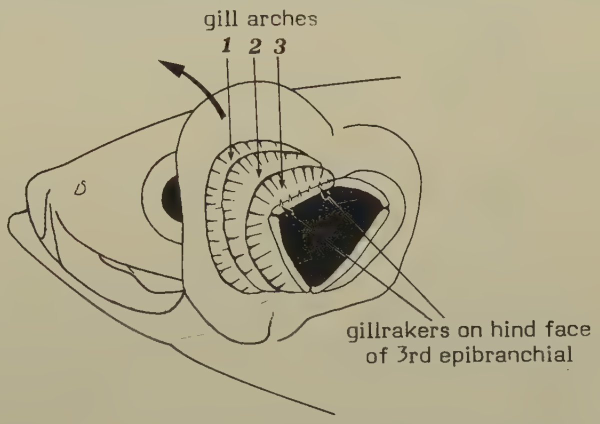
Gilchristella Fowler, 1935

CLUP Gil

Gilchristella Fowler, 1935, Proc.Acad.nat.Sci.Philad., **87**:365, fig. 4 (type: Spratelloides aestuarius Gilchrist, 1914).

Diagnostic Features : Small pellonulines of southern Africa reaching about 6.5 cm standard length. Thin scutes, unkeeled and barely visible, with slender lateral arms present before pelvic fins, none behind. Lower jaw slightly projecting; second supra-maxilla paddle-shaped. Lower gillrakers 42 to 76 (at 4 to 6.3 cm standard length); gillrakers small but present on posterior face of third epibranchial. Branchiostegal rays 6 or 7. Pelvic fin with i 7 finrays, its insertion below or just before dorsal fin origin; anal fin origin just behind last dorsal finray. Scales present, about 40 in lateral series. Distinguished from all other clupeids in the area by the presence of unkeeled pre-pelvic scutes.





Biology, Habitat and Distribution : Rivers, estuaries, lakes and lagoons of the eastern and western coasts of southern Africa (Lake Piti, Mozambique to Saldanha Bay and perhaps Orange River mouth).

Interest to Fisheries : Little or none.

Species : A single species recognized, but a second species has been suspected (Talwar & Whitehead, 1971:69):

G. aestuarius Gilchrist, 1914, South African fresh- and brackishwaters.

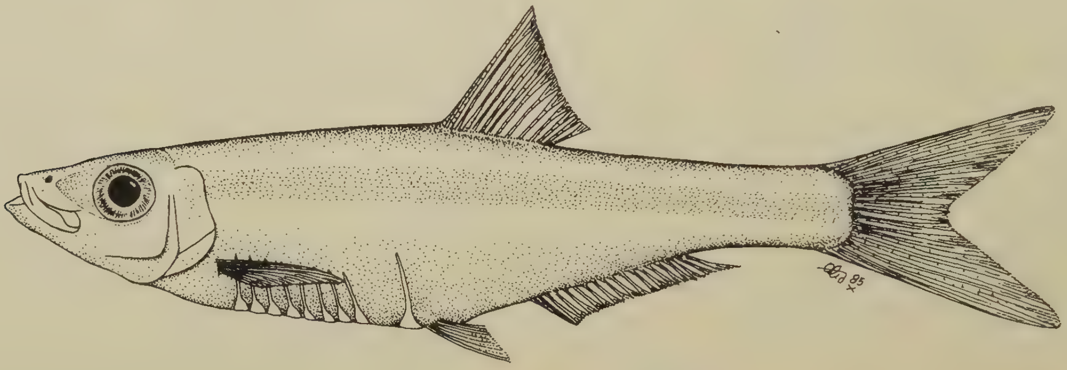
Gilchristella aestuarius (Gilchrist, 1914)

CLUP Gil 1

Spratelloides aestuarius Gilchrist, 1914, Mar.biol.Rep.S.Afr., (1):55 (Swartkops River, Port Elizabeth).

Synonyms : Stolephorus aestuarius:Fowler, 1941:569 (Blue Lagoon, Natal); Ehirava madagascariensis: Whitehead, 1963:333 (only the 11 Buffalo River specimens); Gilchristella aestuarius - Whitehead, 1963:334, fig. 13 (St. Lucia south to Knysna estuary); Talwar & Whitehead, 1971 (key, Buffalo River specimens); Whitehead 1973:194, fig. 24 (key, synonymy, refs); CLOFFA, 1984:44 (synonymy); SFSA, in press (key, descr.).

FAO Names : En - Gilchrist's round herring.



Diagnostic Features : Body rather compressed, belly rounded, with 6 to 9 thin unkeeled pre-pelvic scutes (difficult to see unless scales removed) followed by an equally thin pelvic scute, all with slender ascending arms; no post-pelvic scutes. Snout pointed, lower jaw a little prominent, with a single row of fine teeth in each jaw; second supra-maxilla paddle-shaped. Gillrakers 39 to 45 (but to 76 in Buffalo River fishes); gillrakers small but present on posterior face of third epibranchial. Pelvic fin with i 7 finrays, under or a little before dorsal fin origin. Resembles Spratelloides spp. or juvenile Etrumeus and Dussumieria, but pre-pelvic scutes present; other clupeids in area have keeled pre-pelvic and post-pelvic scutes.

Geographical Distribution : Lake Piti, Mozambique along southern African coast to Saldanha Bay, possibly to mouth of Orange River (but range perhaps confused by presence of a second undescribed species - see below).

Habitat and Biology : Rivers, lakes, estuaries and lagoons, apparently able to tolerate brackishwater. More data needed.

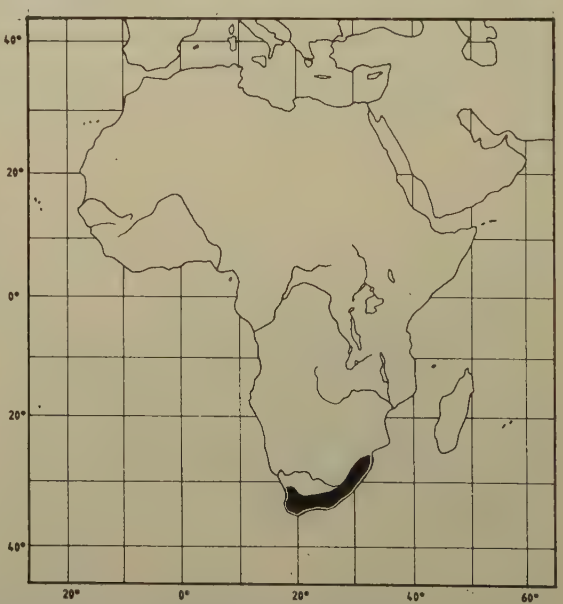
Size : To 6.5 cm standard length.

Interest to Fisheries : Little or none.

Local Names : -

Literature : Twenty-one references in CLOFFA (1984).

Remarks : The Buffalo River specimens, placed in Ehirava madagascariensis by Whitehead (1963:333), had 40 to 56 gillrakers, while specimens from other localities, given as Gilchristella aestuarius, had only 39 to 45 gillrakers; later work suggested other differences between the two (Talwar & Whitehead, 1971:68,69) and the gillraker count for 'aberrant' specimens was found to be as high as 76. A second species of Gilchristella is thus probable.



Sauvagella Bertin, 1940

CLUP Sauv

Sauvagella Bertin, 1940, Bull.Mus.natn.Hist.Nat.Paris, (2)**12**(6):300 (type: Spratelloides madagascariensis Sauvage, 1883 - but excluding S. madagascariensis bianalis Bertin, 1940, which is Spratellomorpha bianalis). Pellonulops Smith, 1949 (June), Ann.Mag.nat.Hist., (12)**2**:98 (type: Spratelloides madagascariensis Sauvage, 1883); Idem, 1949, Seafish.S.Africa:91 (? published after June).

Diagnostic Features : Small elongate pellonulines of Madagascar reaching about 4.6 cm standard length. No pre-pelvic scutes, but pelvic scute with slender vertical arms (W-shaped in Spratelloides, Dussumieria, Etrumeus). Jaws about equal or lower slightly projecting. Lower gillrakers about 20; gillrakers present on posterior face of third epibranchial (see Gilchristella). Pelvic fin with i 7 finrays, its insertion a little before dorsal fin origin; anal fin without last two finrays separate (cf. Spratellomorpha).

Biology, Habitat and Distribution : Freshwaters of Madagascar.

Interest to Fisheries : None.

Species : A single species recognized:

S. madagascariensis (Sauvage, 1883), Madagascar, freshwaters.

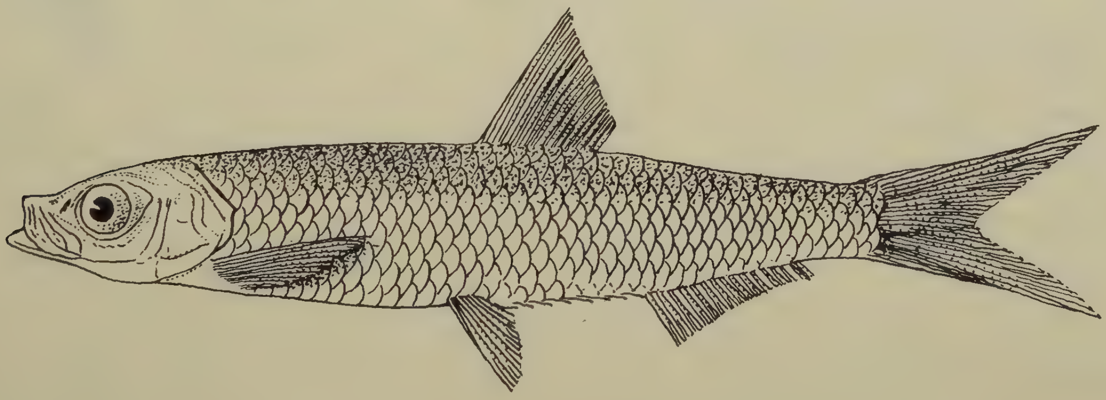
Sauvagella madagascariensis (Sauvage, 1883)

CLUP Sauv 1

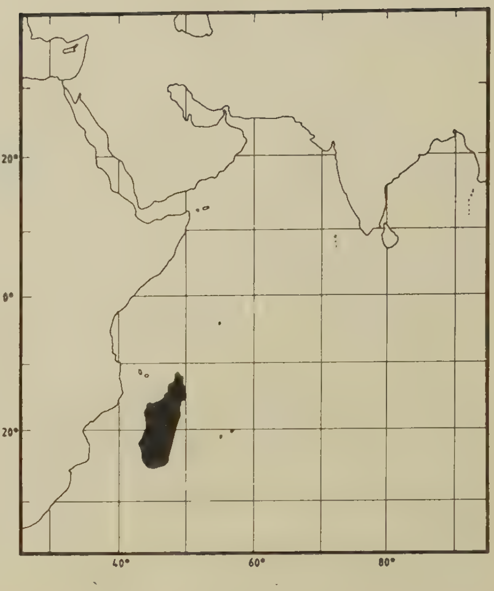
Spratelloides madagascariensis (part) Sauvage, 1883, Bull.Soc.philomath.Paris, (7)**7**:160 (Madagascar; excluding the form bianalis Bertin, 1940, based on 12 of the syntypes = Spratellomorpha bianalis).

Synonyms : Sauvagella madagascariensis longianalis and brevidorsalis Bertin, 1940; Pellonulops madagascariensis:Smith, 1949a:98 (in part on South African specimens of Gilchristella aestuarius, but diagnosis mainly on Sauvage, 1883); Ehirava madagascariensis:Whitehead, 1963:333 (type, but 11 Buffalo River G. aestuarius included in error); Sauvagella madagascariensis - Talwar & Whitehead, 1971:67 (key); Whitehead, 1973:193, fig. 22 (key, synonymy, refs); CLOFFA, 1984 (synonymy); Whitehead & Bauchot, in press:types).

FAO Names : En - Madagascar round herring.



Diagnostic Features : Body elongate, a little compressed, belly rounded, without pre-pelvic scutes, but a pelvic scute present with slender vertical arms. Gillrakers probably few (19 at 4 cm standard length in one syntype). Pelvic fin with i 7 finrays, under or a little before dorsal fin origin; last two anal finrays not separate from others (cf. Spratellomorpha bianalis). Distinguished from other non-scuted clupeids in area (Spratelloides, Dussumieria, Etrumeus) by presence of normal pelvic scute (cf. W-shaped).



Geographical Distribution : Freshwaters of Madagascar.

Habitat and Biology : Freshwaters, possibly tolerating brackishwater. More specimens and data needed.

Size : To about 5 cm standard length, perhaps more.

Interest to Fisheries : Little or none.

Local Names : -

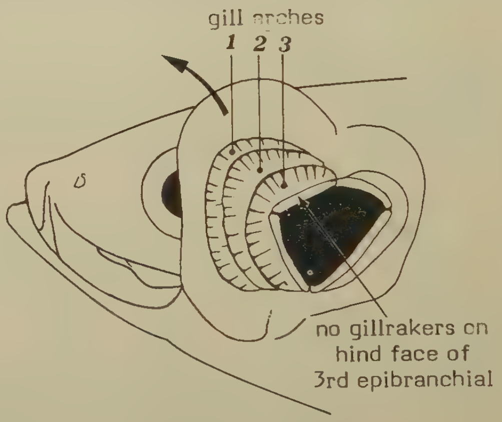
Literature : Only 11 references in CLOFFA (1984), mostly repetitive.

Spratellomorpha Bertin, 1946

CLUP Spratm

Spratellomorpha Bertin, 1946, in Angel, Bertin & Guibé, Bull.Mus.natn.Hist.nat.Paris, (2)**18**:473-474 (type: Sauvagella madagascariensis bianalis Bertin, 1940).

Diagnostic Features : Small pellonulines of East Africa and Madagascar reaching about 4.5 cm standard length. No pre-pelvic scutes, but pelvic scute with slender vertical arms (W-shaped in Spratelloides, Dussumieria, Etrumeus). Snout pointed, lower jaw projecting slightly. Lower gillrakers 26 to 31; gillrakers absent on posterior face of third epibranchial. Pelvic fin with i 7 finrays, its insertion well before dorsal fin origin; last two anal finrays separate, forming a distinct little finlet (otherwise known only in the Indian and Southeast Asian genera Corica and Clupeichthys).



Biology, Habitat and Distribution : Marine or estuarine in Madagascar, also Kenya.

Interest to Fisheries : None.

Species : A single species recognized:

S. bianalis (Bertin, 1940), Madagascar, Kenya, marine or estuarine.

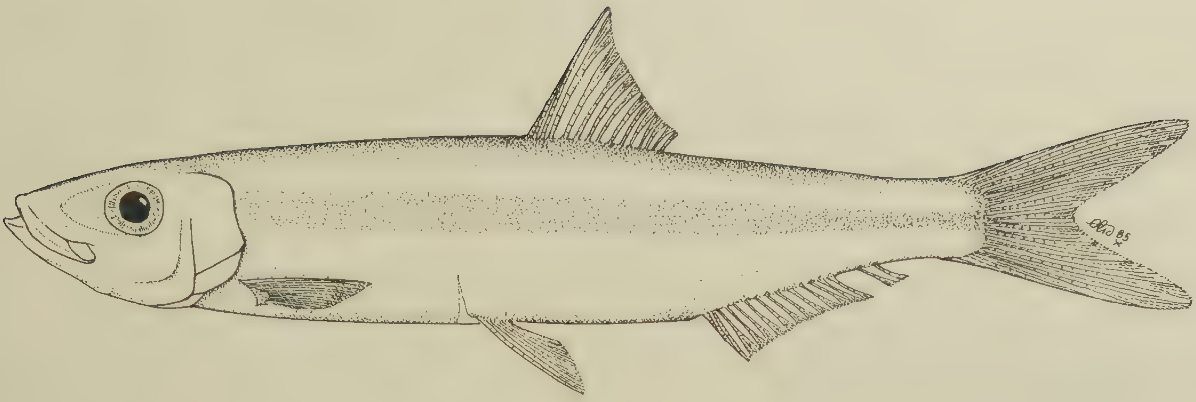
Spratellomorpha bianalis (Bertin, 1940)

CLUP Spratm 1

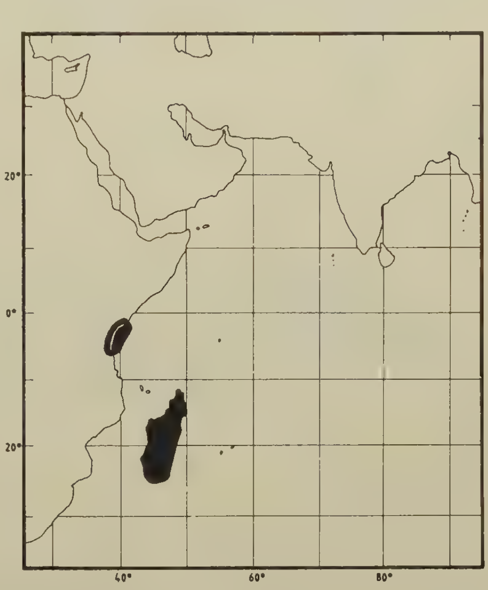
Spratelloides madagascariensis (part) Sauvage, 1883, Bull.Soc.philomat.Paris, (7)**7**:160 (Madagascar, excluding the forms longianalis and brevidorsalis of Bertin, 1940, based on two of the syntypes = Sauvagella madagascariensis).

Synonyms : Sauvagella madagascariensis bianalis Bertin, 1940 (types); Sauvagella bianalis:Whitehead, 1963:336, fig. 14 (types, descr.); Spratellomorpha bianalis - Losse, 1968:84 (Mombasa, descr.); Talwar & Whitehead, 1971:68 (key); Whitehead, 1973:194, fig. 23 (key, synonymy, refs); CLOFFA, 1984:54 (synonymy); Whitehead & Bauchot, in press:types).

FAO Names : En - Two-finned round herring.



Diagnostic Features : Body elongate, a little compressed, belly rounded, without pre-pelvic scutes, but a pelvic scute present with slender vertical arms. Gillrakers 26 to 31. Pelvic fin with i 7 finrays, well before dorsal fin origin; last two anal finrays separate, forming a distinct little finlet. This last feature identifies the species (found in no other clupeoid of the western Indian Ocean).



Geographical Distribution : Madagascar (no locality given in original description) and Kenya coast (stake traps at entrance to Port Tudor, Mombasa; probably more widespread).

Habitat and Biology : Presumed marine or estuarine, but more specimens and data needed.

Size : To 4.5 cm standard length.

Interest to Fisheries : Apparently rare.

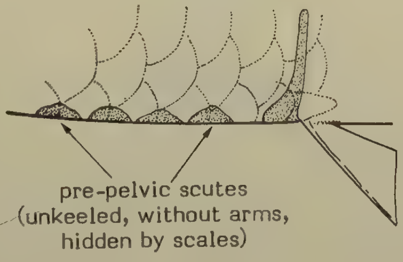
Local Names : -

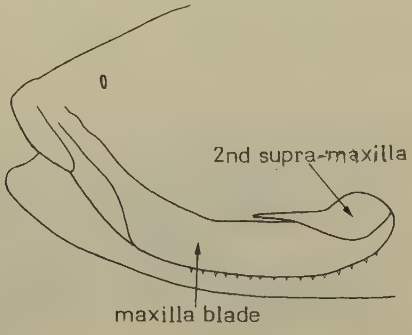
Literature : Losse (1968 - best description to date); only five references in CLOFFA (1984).

Ehirava Deraniyagala, 1929

CLUP Ehir

Ehirava Deraniyagala, 1929, *Spolia zeylan.*, **15**:34 (type: *Ehirava fluviatilis* Deraniyagala, 1929).





Diagnostic Features : Small slender-bodied pellonulines of southern India and Sri Lanka reaching about 5 cm standard length. Thin scutes, unkeeled and barely visible before pelvic fins, none behind. Jaw teeth very weakly developed. Gillrakers 24 to 30; no gillrakers on posterior face of third epibranchial (see *Spratellomorpha*). Branchiostegal rays 5 or 6. Pelvic fin with i 7 finrays, its insertion a little before dorsal fin origin; anal fin origin well behind last dorsal finray. Scales moderate, 36 to 40 in lateral series. Distinguished from all other clupeids in its area by the presence of unkeeled pre-pelvic scutes and no post-pelvic scutes.

Biology, Habitat and Distribution : Rivers and estuaries, tolerant of brackishwater; coasts of southern India and Sri Lanka.

Interest to Fisheries : Of local importance.

Species : A single species recognized (Whitehead, 1963:333 wrongly included *Spratelloides madagascariensis* Sauvage, 1883, now placed in *Sauvagella*):

E. fluviatilis Deraniyagala, 1929, southern India.

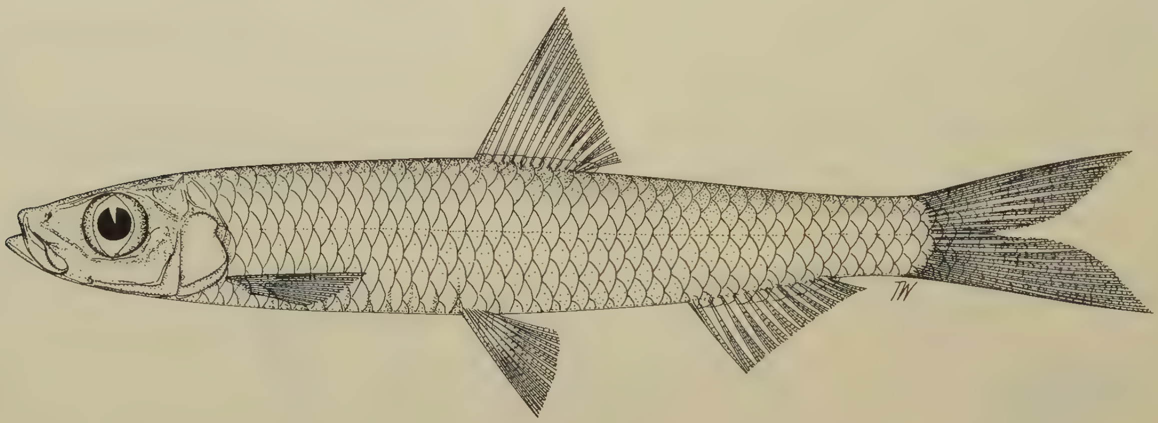
Ehirava fluviatilis Deraniyagala, 1929

CLUP Ehir 1

Ehirava fluviatilis Deraniyagala, 1929, *Spolia zeylan.*, **15**:35, pl. 14 (western province of Sri Lanka).

Synonyms : *Ehirava malabaricus* (part):Whitehead, 1963:331 (8 types of *E. fluviatilis*, but mixed with 5 Malabar specimens of *Dayella malabarica*); *Ehirava fluviatilis* - Talwar & Whitehead, 1971:68 (key); Whitehead, 1973:196, fig. 25 (key, synonymy, refs); Wongratana, 1980:90, pls 13, 14 (revision).

FAO Names : En - Malabar sprat.



Diagnostic Features : Body slender, belly rather rounded, with 5 to 8 thin unkeeled pre-pelvic scutes (difficult to see unless scales removed), followed by an equally thin pelvic scute, all with slender ascending arms; no post-pelvic scutes. Snout pointed, lower jaw a little prominent, with barely visible teeth in each jaw; second supra-maxilla short, about half length of maxilla blade. Gillrakers 24 to 30. Pelvic fin insertion just before dorsal fin origin. Closely resembles *Gilchristella* of southern African and the sympatric *Dayella* (but gillrakers present on posterior face of third epibranchial; also, pelvic insertion just behind dorsal fin origin in *Dayella*, cf. just before in *Ehirava*). See CLUP Ehir 1, Fishing Area 31.

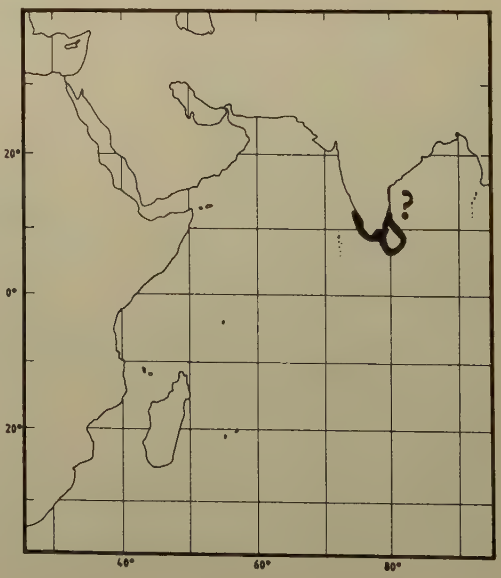
Geographical Distribution : Southern India and Sri Lanka.

Habitat and Biology : Estuaries, lagoons and as much as 10 km up rivers, presumably tolerating a wide range of salinity.

Size : To 5 cm standard length, usually about 4 cm.

Interest to Fisheries : Of local importance, caught with seines and liftnets, marketed fresh or dried salted.

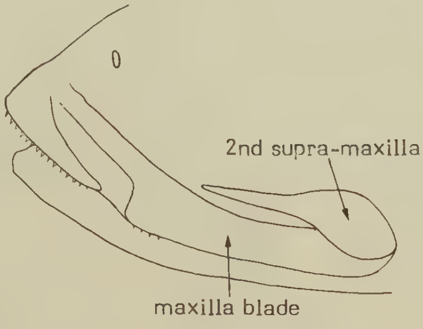
Local Names : SRI LANKA: Ehirava.

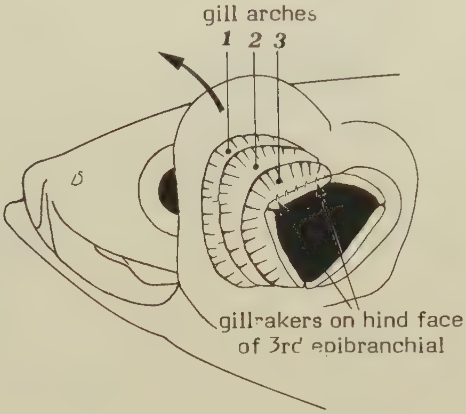


Dayella Talwar & Whitehead, 1971

CLUP Day

Dayella Talwar & Whitehead, 1971, Bull.Br.Mus.nat.Hist.(Zool.), **22**(2):63 (type: Spratelloides malabarica Day, 1873).





Diagnostic Features: Small pellonulines of southern India, reaching about 6 cm standard length. Small irregular scutes (1 to 4) underlying scales of belly, with only rudimentary lateral arms; pelvic scute normal, but without keel. Lower jaw slightly projecting; second supra-maxilla rather spatulate. Lower gillrakers 24 to 27; about 7 short gillrakers on posterior face of third epibranchial. Branchiostegal rays 5. Pelvic fin with i 7 finrays, its insertion somewhat behind dorsal fin origin; anal fin origin well behind last dorsal finray. Closely resembles Ehirava, which lacks gillrakers on the posterior face of the third epibranchial and has the pelvic insertion before the dorsal fin origin.

Biology, Habitat and Distribution: Rivers and estuaries of southwestern coasts of India.

Interest to Fisheries: Probably none.

Species: A single species recognized:

D. malabarica (Day, 1873), southwestern India, fresh- and brackishwaters.

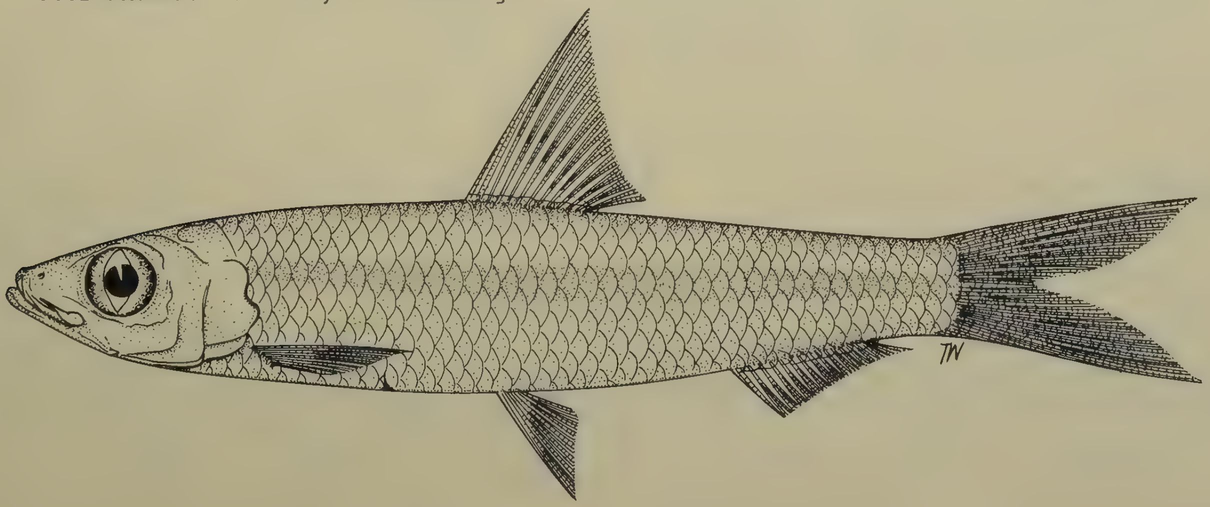
Dayella malabarica (Day, 1873)

CLUP Day 1

Spratelloides malabaricus Day, 1873, Proc.zool.Soc.Lond.:240 (Malabar, India).

Synonyms: Ehirava malabaricus:Whitehead, 1963:331 (confused with E. fluviatilis); Dayella malabarica - Talwar & Whitehead, 1971:63, fig. 1b (scutes) (Malabar, Canara, descr., new genus); Whitehead, 1973:195 (key, synonymy, refs); Wongratana, 1980:91, pls 15, 16 (revision).

FAO Names: En - Day's round herring.



Diagnostic Features: Body slender, belly rather rounded, with 1 to 4 thin, unkeeled and irregular scutes (hidden by scales) without vertical arms; pelvic scute with vertical arms (not W-shaped, cf. *Spratelloides*, *Dussumieria*); no post-pelvic scutes. Snout pointed, lower jaw a little prominent, small but distinct teeth in each jaw; second supra-maxilla long, about 3/4 length of maxilla blade. Gillrakers 24 to 27. Pelvic insertion behind dorsal fin origin. Closely resembles the sympatric *Ehirava fluviatilis*, which has the pelvic insertion just before dorsal fin origin and no gillrakers on the posterior face of the third epibranchial.

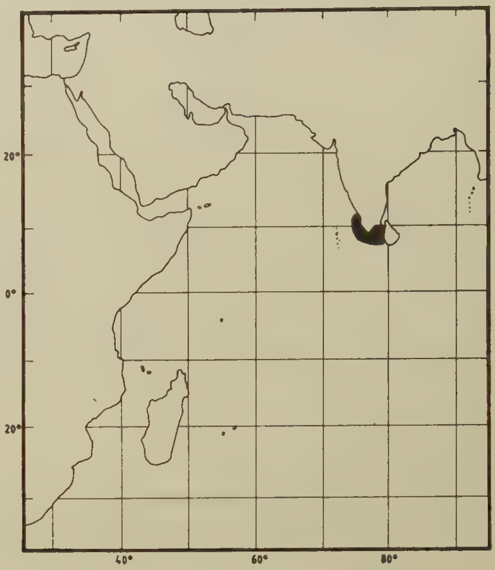
Geographical Distribution: Southwestern India.

Habitat and Biology: Rivers and estuaries; more specimens and data needed.

Size: To about 6 cm standard length.

Interest to Fisheries: Probably none.

Local Names: -



Clupeoides Bleeker, 1851

CLUP Clupeoi

Clupeoides Bleeker, 1851, *Natuurk.Tijdschr.Ned.-Indië*, 1:27 (type: *Clupeoides borneensis* Bleeker, 1851).

Diagnostic Features: Southeast Asian freshwater pellonulines reaching about 8.6 cm. Prominently keeled scutes both before and behind pelvic fin base, belly compressed. Lower gillrakers 12 to 24. Pelvic finrays i 7, its insertion a little before dorsal fin origin; anal fin entire, last two finrays not forming a separate finlet (cf. *Corica* and *Clupeichthys*).

Biology, Habitat and Distribution: Rivers of southeast Asia and Papua New Guinea.

Interest to Fisheries: Probably rather little.

Species: Four species recognized by Wongratana (1980):

C. borneensis Bleeker, 1851, southeast Asia, freshwater
C. hypselosoma Bleeker, 1866, Kalimantan, freshwater
C. papuensis (Ramsey & Ogilby, 1886), Papua New Guinea, freshwater
C. venulosus Weber & deBeaufort, 1912, Papua New Guinea, freshwater.

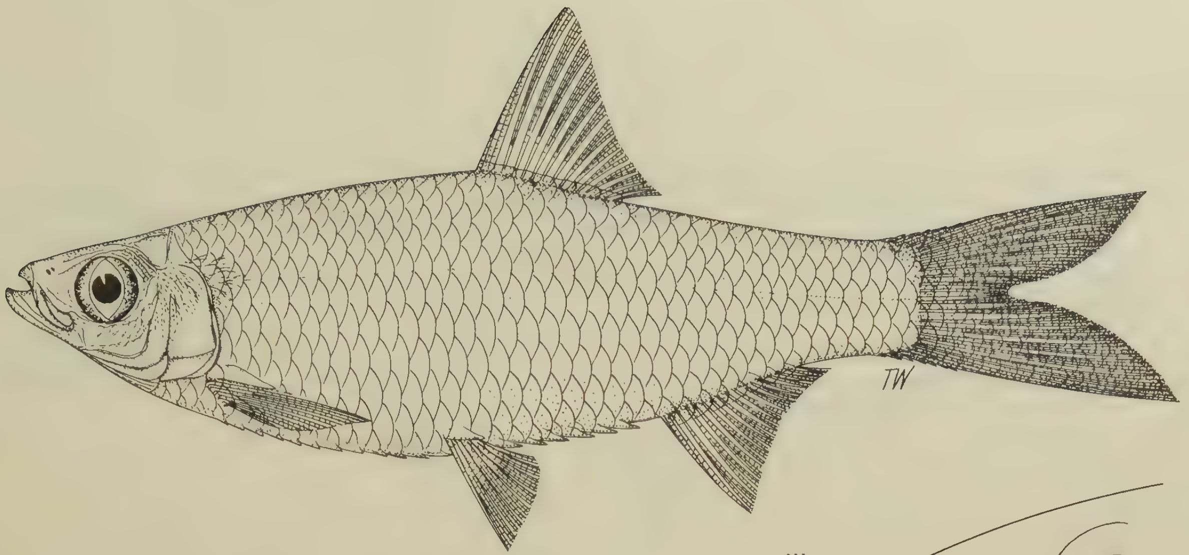
Clupeoides borneensis Bleeker, 1851

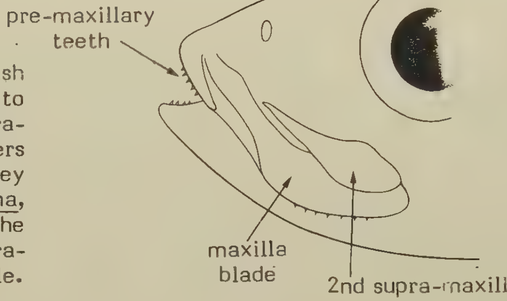
CLUP Clupeoi 1

Clupeoides borneensis Bleeker, 1851, *Natuurk.Tijdschr.Ned.-Indië*, 1:275 (Banjermasin, Kalimantan, Indonesia).

Synonyms: *Clupeoides exilis* Fowler, 1935:92, fig. 12 (Bangkok); Fowler, 1941:637 (repeat); *Kowala borneensis*: Fowler, 1941:636 (on Bleeker); *Clupeoides borneensis*: Whitehead, Boeseman & Wheeler, 1966:73, pl. 8 (2) (types); Wongratana, 1980:92, pls 17, 18 (revision).

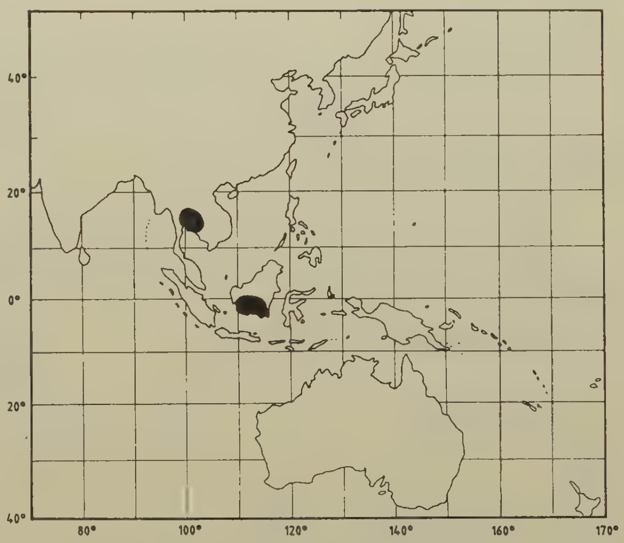
FAO Names: En - Borneo river sprat.





Diagnostic Features : Body depth increasing with size of fish (from 21 to 34% of standard length), belly sharply keeled, with 9 to 12 + 6 to 9 scutes. Pre-maxillae long and toothed; second supra-maxilla as long as or longer than blade of maxilla. Lower gillrakers 18 to 24. Pectoral axillary scale at least 1/3 length of fin. No grey or silvery stripe along flank. Closely resembles C. hypselosoma, which has only 12 to 19 lower gillrakers and a silver stripe down the flank. Other Clupeoides spp. have a much shorter second supra-maxilla, no pre-maxillary teeth and a shorter pectoral axillary scale.

Geographical Distribution : Indonesia (Kalimantan), Thailand (Ayudhya and Nakornswan, 100 to 260 km up river), Cambodia, Viet Nam (southern part).



Habitat and Biology : Freshwater, in rivers. More data needed.

Size : To 7 cm standard length.

Interest to Fisheries : Perhaps makes a small contribiution to river fisheries.

Local Names : -

Literature : Chevey & Poulain (1940 - Cambodia); Taki (1975 - Viet Nam).

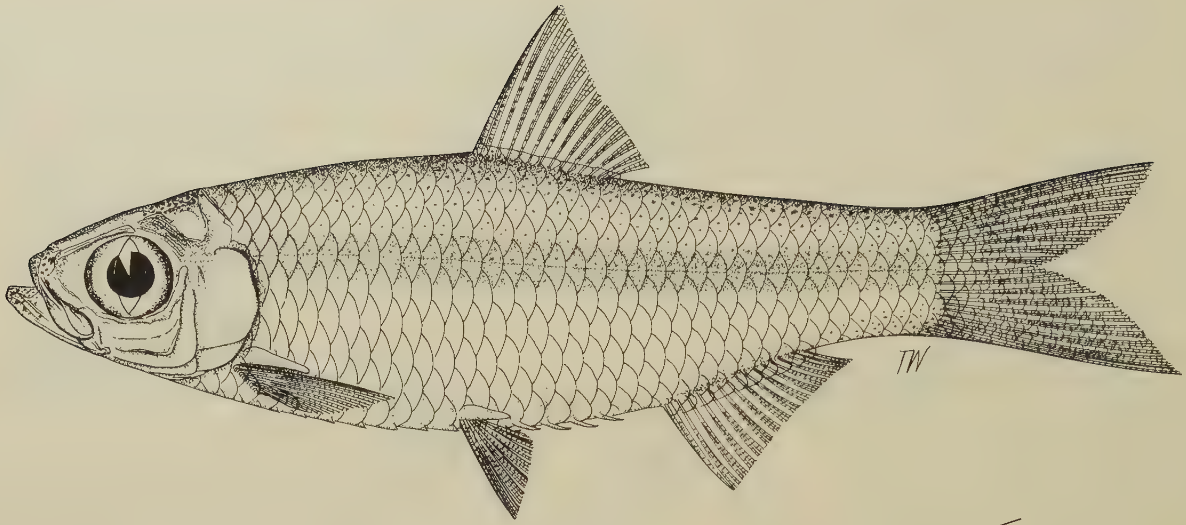
Clupeoides hypselosoma Bleeker, 1866

CLUP Clupeoi 2

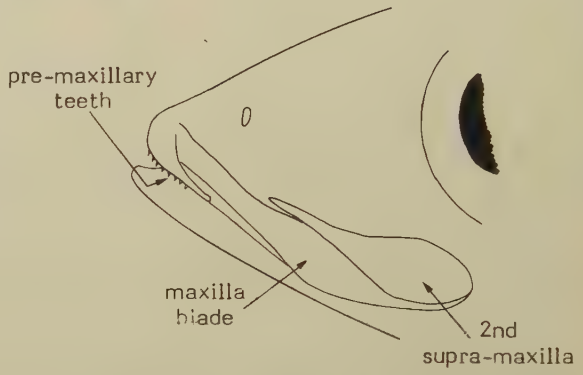
Clupeoides hypselosoma Bleeker, 1866, Ned.Tijdschr.Dierk., 3:293 (Banjermasin, Kalimantan, Indonesia).
Clupea (Clupeoides) potamophilus Bleeker, 1872, Atlas Ichth.Ind.Néerland., 6:101 (on C. hypselosoma).

Synonyms : Kowala hypselosoma:Fowler, 1941:637 (on Bleeker); Whitehead, Boeseman & Wheeler, 1966:74, pl. 8 (3) (holotype); Wongratana, 1980:93, pl. 16 (revision).

FAO Names : En - Kalimantan river sprat.



Diagnostic Features : Body moderately deep, belly sharply keeled, with 7 + 6 scutes. Pre-maxillae long and toothed; second supra-maxilla as long as or longer than blade of maxilla. Lower gillrakers 12 to 19. Pectoral axillary scale at least 1/3 length of fin. A prominent silver strip along flank. Closely resembles C. borneensis (sympatric in Kalimantan), which has more lower gillrakers (18 to 24), but no silver stripe along flank. Other Clupeoides spp. have a much shorter second supra-maxilla, no pre-maxillary teeth and a shorter pectoral axillary scale.



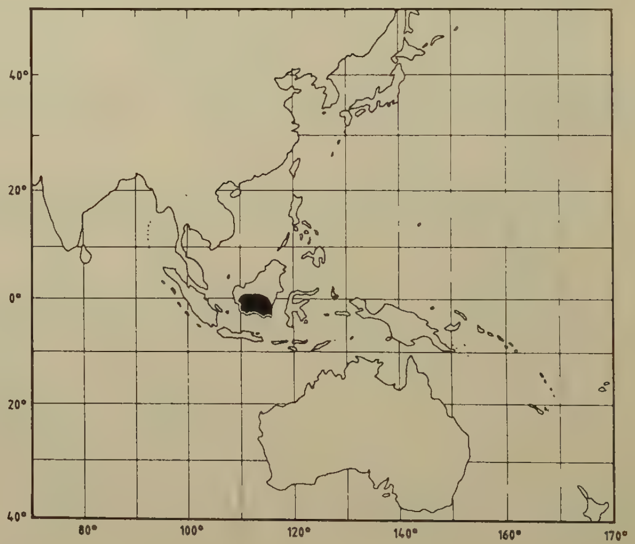
Geographical Distribution : Indonesia (Barito and Kapuas Rivers).

Habitat and Biology : Freshwater, in rivers. More specimens and data needed.

Size : To 4.2 cm standard length, perhaps more.

Interest to Fisheries : Perhaps makes a small contribution to river fisheries.

Local Names : -



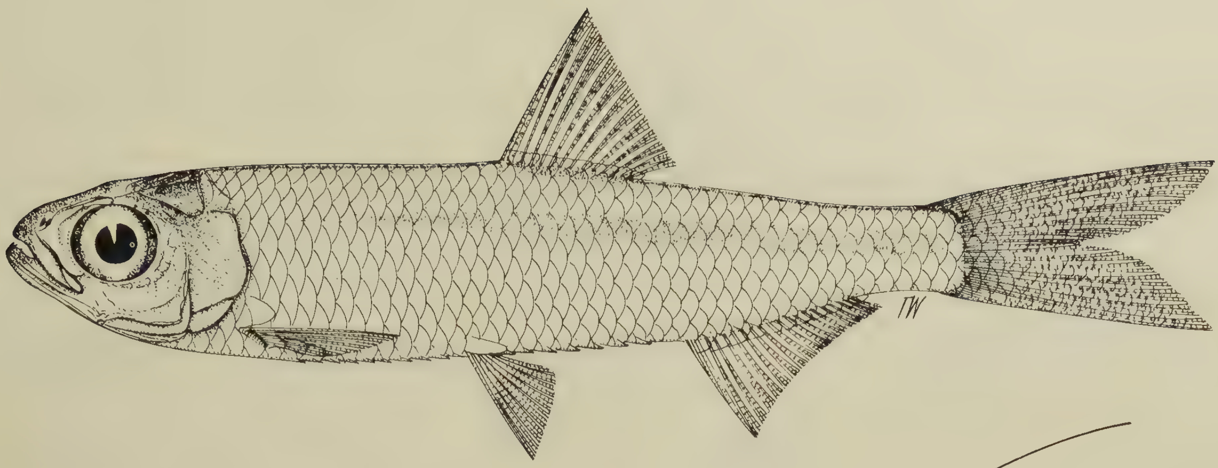
Clupeoides papuensis (Ramsey & Ogilby, 1886)

CLUP Clupeoi 3

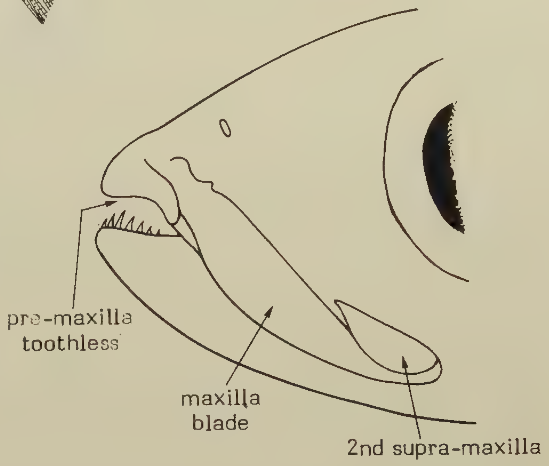
Clupea papuensis Ramsey & Ogilby, 1886, Proc.Linn.Soc.N.S.W., (2)**1**:19 (Strickland River, Papua New Guinea).

Synonyms : Clupeoides multispinus Hardenberg, 1941:219 (lower part of Digoel river, Papua New Guinea); Kowala papuensis:Fowler, 1941:636 (on Ramsey & Ogilby); Munro, 1967:51, pl. 4 (51) (compiled); Clupeoides papuensis - Wongratana, 1980:94, pls 19, 20 (revision).

FAO Names : En - Papuan river sprat.



Diagnostic Features: Body moderately elongate, its depth 17 to 23% of standard length, belly sharply keeled, with (9) 10 or 11 (12) + (7) 8 or 9 (10) scutes. Snout blunt, pre-maxillae short and toothless, but prominent teeth in lower jaw; second supra-maxilla short, about half length of maxilla blade. Lower gillrakers 15 to 19. Pectoral axillary scale small, less than 1/3 length of fin. A silver stripe along flank, tapering anteriorly. Closely resembles the deeper-bodied sympatric C. venulosus (depth 26 to 29% of standard length; also, pre-dorsal scales 14 or 15, cf. 17 to 19 in C. papuensis). Other Clupeoides spp. have a long and toothed pre-maxilla, also pectoral axillary scale 1/3 length of fin or more.



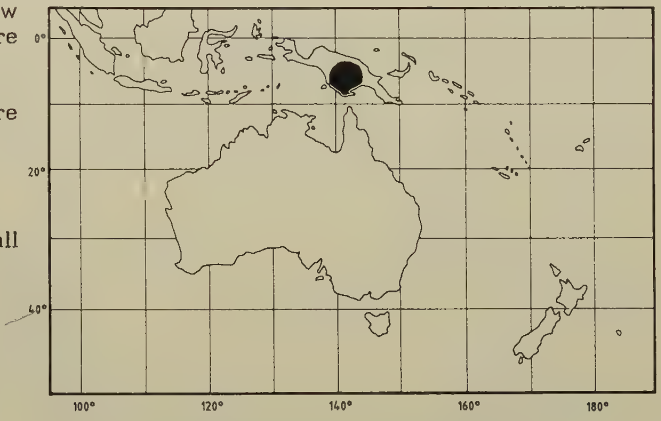
Geographical Distribution: Southern Papua New Guinea (Strickland, Fly and Digoel Rivers; possibly more widespread).

Habitat and Biology: Freshwater, in rivers. More specimens and data needed.

Size: To 7.7 cm standard length.

Interest to Fisheries: Perhaps makes a small contribution to river fisheries.

Local Names: -



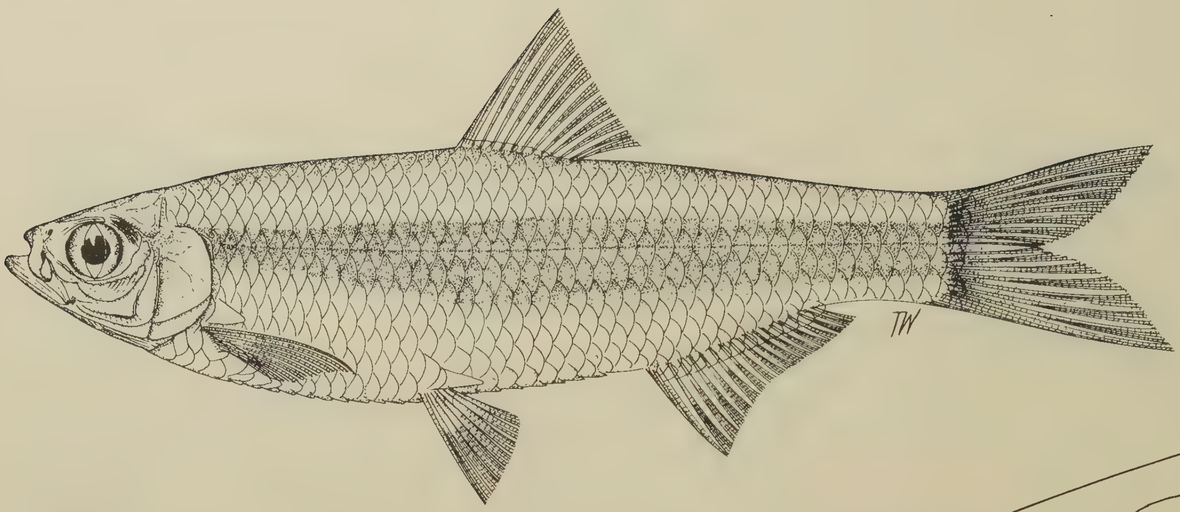
Clupeoides venulosus Weber & DeBeaufort, 1912

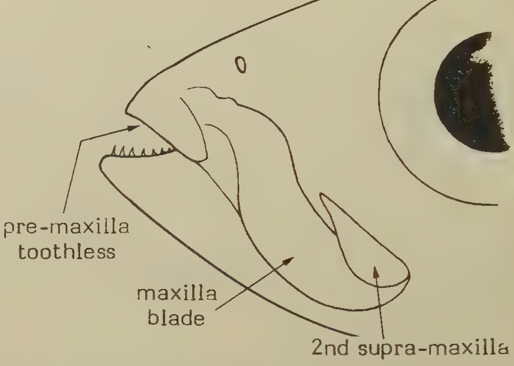
CLUP Clupeoi 4

Clupeoides venulosus Weber & DeBeaufort, 1912, Verh.K.Akad.Wet.Amst., **17**:3 (Lorentz River, Irian Jaya).

Synonyms: Kowala venulosus:Fowler, 1941:638 (on Weber & DeBeaufort); Munro, 1967:50 (in key only); Clupeoides venulosus - Wongratana, 1980:96, pls 21, 22 (revision).

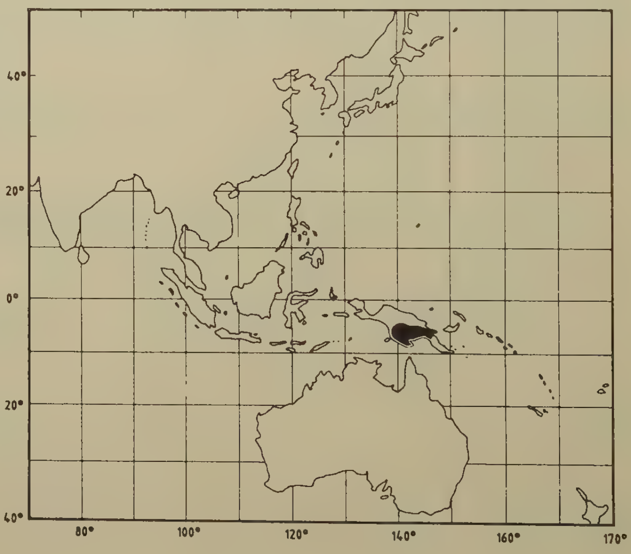
FAO Names: En - West Irian river sprat.





Diagnostic Features: Body moderately deep, its depth 26 to 29% of standard length, belly sharply keeled, with 9 to 12 + 7 to 9 scutes. Snout blunt, pre-maxillae short and toothless, but prominent teeth in lower jaw; second supra-maxilla short, a little over half length of maxilla blade. Lower gillrakers 16 or 17. Pectoral axillary scale small, less than 1/3 length of fin. A silver stripe along flank, tapering anteriorly. Closely resembles the more slender-bodied sympatric C. papuensis (depth 17 to 23% of standard length; also, pre-dorsal scales 17 to 19, cf. 14 or 15 in C. venulosus). Other Clupeoides spp. have a long and toothed pre-maxilla, also pectoral axillary scale 1/3 length of fin or more.

Geographical Distribution: Indonesia (in Lorentz River, Irian Jaya) and Papua New Guinea (Fly River); probably in other southwest-flowing rivers in area.



Habitat and Biology: Freshwater, in rivers. More specimens and data needed.

Size: To 8.6 cm standard length.

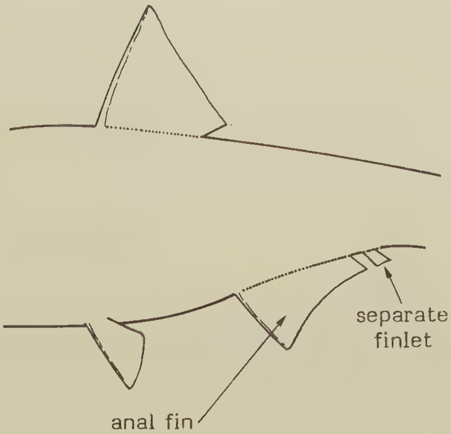
Interest to Fisheries: Perhaps makes a small contribution to river fisheries.

Local Names: -

Corica Hamilton-Buchanan, 1822

CLUP Coric

Corica Hamilton-Buchanan, 1822, Fishes of Ganges:253, 283 (type: Corica soborna Hamilton-Buchanan, 1822).



Diagnostic Features: Small Indian and southeast Asian freshwater pellonulines reaching about 5 cm standard length. Keeled scutes both before and behind pelvic fin base, belly compressed. Jaw teeth minute or absent, none along sides of lower jaw. Lower gillrakers 19 to 27. Pelvic finrays i 7, its insertion in advance of dorsal fin origin; last two anal finrays separated from rest of fin, forming a distinct finlet. Resembles Clupeichthys in this latter feature (but jaw teeth prominent and continued along sides of lower jaw).

Biology, Habitat and Distribution: Rivers of India (Orissa) and southeast Asia.

Interest to Fisheries: Perhaps make a small contribution.

Species: Two species recognized by Wongratana (1980):

C. laciniata Fowler, 1935, southeast Asia, freshwater, estuarine
C. soborna Hamilton-Buchanan, 1822, India, southeast Asia, freshwater.

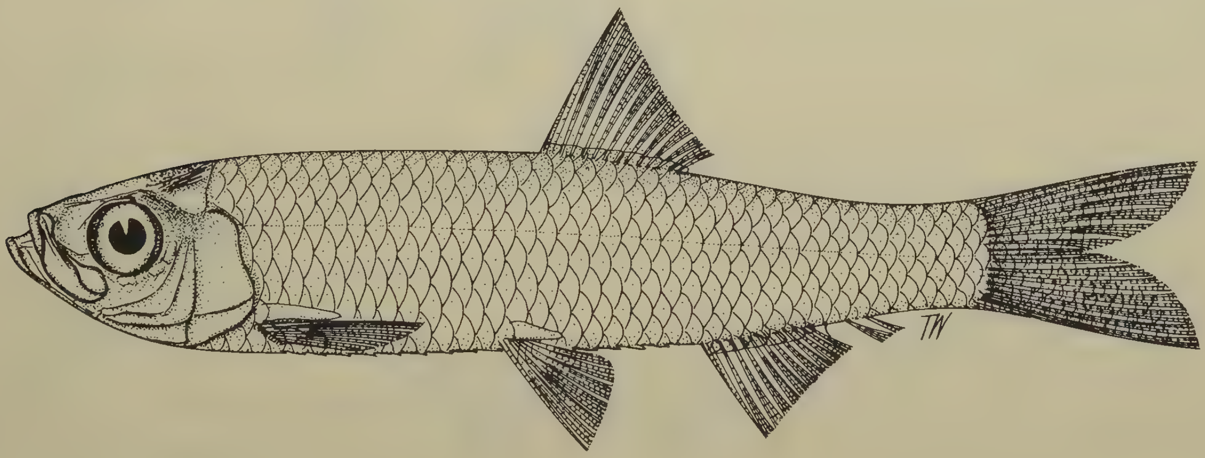
Corica laciniata Fowler, 1935

CLUP Coric 1

Corica laciniata Fowler, 1935, Proc.Acad.nat.Sci.Philad., **87**:92, fig. 11 (Bangkok, Paknam).

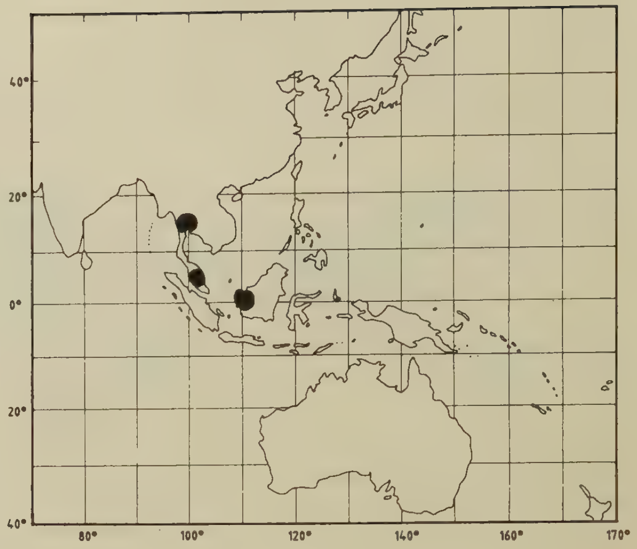
Synonyms: Corica laciniata - Fowler, 1941:646 (Bangkok, Paknam, Thailand); Wongratana, 1980:96, pls 23, 24 (revision).

FAO Names: En - Bangkok river sprat.



Diagnostic Features: Body moderately elongate, belly keeled, with 10 to 12 + 6 to 8 (usually 11 + 7) scutes. Teeth minute or absent in jaws; second supra-maxilla at least as long as maxilla blade. Lower gillrakers 23 to 27. Last two anal finrays forming a separate finlet. Resembles C. soborna (sympatric in Kalimantan), which has fewer gillrakers (19 to 21), but more pre-dorsal bones (12, cf. 9 in C. laciniata). Species of Clupeichthys also have a separate anal finlet, but jaw teeth prominent and present on sides of lower jaw.

Geographical Distribution : Gulf of Thailand (Bangkok, Paknam, Songkla Lake); Kalimantan (Barito River at Banjermasin and Aluhuluh).



Habitat and Biology : Freshwater, in rivers, also in estuaries (but salinities not recorded). More data needed.

Size : To 5 cm standard length.

Interest to Fisheries : Probably none.

Local Names : -

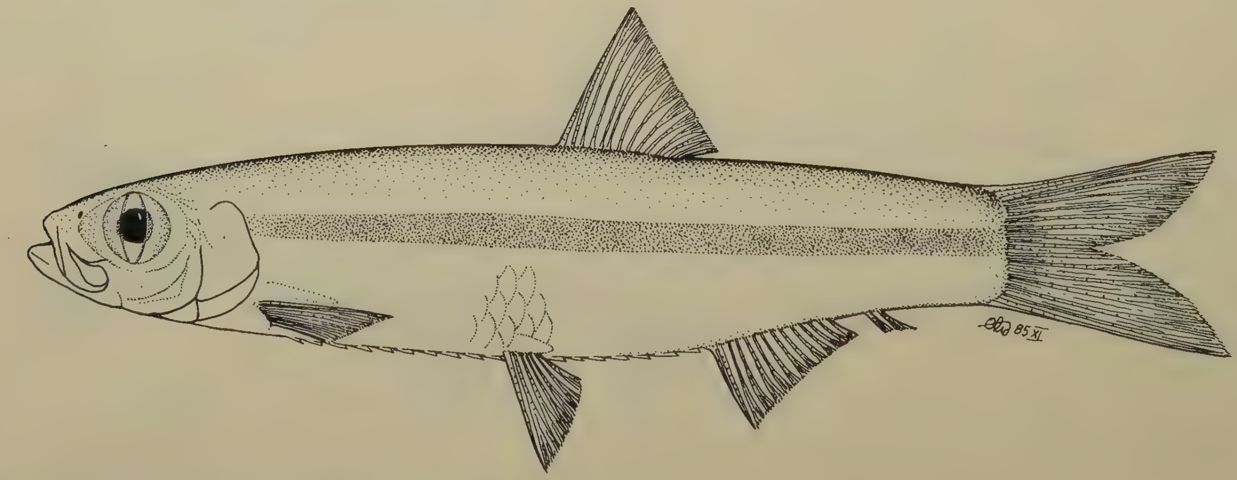
Corica soborna Hamilton-Buchanan, 1822

CLUP Coric 2

Corica soborna Hamilton-Buchanan, 1822, Fishes of Ganges:253, 383 (Mahanadi River, Orissa, India).

Synonyms : Corica argentata Swainson, 1839 (on C. soborna Hamilton-Buchanan, 1822); Spratella pseudopterus Bleeker, 1852 (Pamangkat, Kalimantan - lectotype only, paralectotype = C. laciniata fide Wongratana, 1980:98); Corica soborna:Fowler, 1941:644 (mostly on Day, 1878); Whitehead, Boeseman & Wheeler, 1966:76, pl. 9, fig. 1 (types, Pamangkat); Whitehead, 1973:192, fig. 21 (key, synonyms, but excluding C. perakensis and C. laciniata, refs); Wongratana, 1980:97, pls 25, 26 (revision).

FAO Names : En - Ganges river sprat.



Diagnostic Features : Body fairly elongate, belly keeled, with 11 + 6 or 7 (usually 7) scutes. Teeth minute or absent in jaws; second supra-maxilla at least as long as maxilla blade. Lower gillrakers 19 to 21. Last two anal finrays forming a separate finlet. Resembles C. laciniata (sympatric in Kalimantan, but see Remarks), which has more gillrakers (23 to 27), but fewer pre-dorsal bones (9, cf. 12 in C. soborna). Species of Clupeichthys also have a separate anal finlet, but jaw teeth prominent and present on sides of jaw.

Geographical Distribution : India (Mahanadi River, Orissa; perhaps also rivers of Bengal) and Indonesia (Pamangkat, Kalimantan - but see Remarks).

Habitat and Biology : Freshwater, in rivers, possibly also in estuaries. More specimens and data needed.

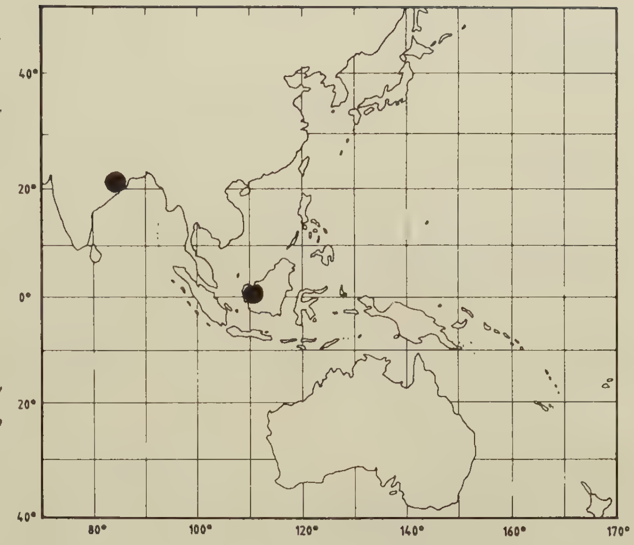
Size : To 4.1 cm standard length, perhaps to 5 cm.

Interest to Fisheries : Probably none.

Local Names : -

Literature : See under synonyms.

Remarks : The Kalimantan record is based solely on the lectotype of Spratella pseudopterus (RMNH 7116), which has damaged gill arches.

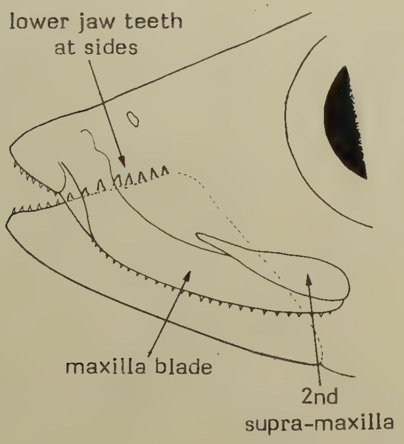


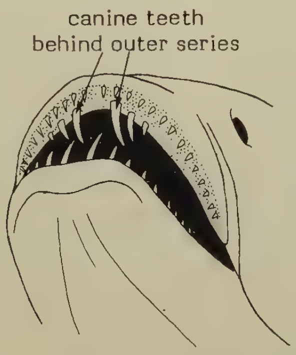
Clupeichthys Bleeker, 1855

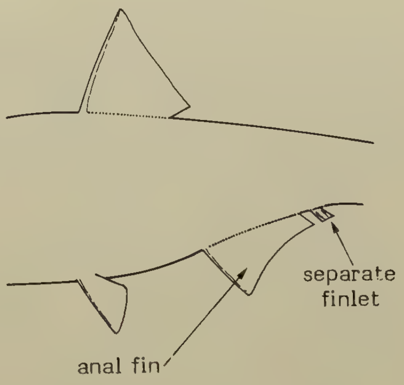
CLUP Clupei

Clupeichthys Bleeker, 1855, Natuurk.Tijdschr.Ned.-Indië, **9**:(260)274 (type:Clupeichthys goniognathus Bleeker, 1855).

Diagnostic Features : Southeast Asian freshwater pellonulines reaching about 6.5 cm standard length. Keeled scutes both before and behind pelvic fin base, belly compressed. Lower jaw teeth large and continued along side of jaw. Lower gillrakers 13 to 19. Pelvic finrays i 6 or 7, its insertion below or a little behind dorsal fin origin; last two anal finrays separated from rest of fin, forming a distinct finlet. Resembles Corica in this latter feature (but teeth small, lower gillrakers 19 to 27).







Biology, Habitat and Distribution : Rivers of southeast Asia.

Interest to Fisheries : Probably rather little.

Species : Four species recognized by Wongratana (1980):

C. aesarnensis Wongratana, 1983, Thailand, freshwater
C. bleekeri (Hardenberg, 1936), Kalimantan, freshwater
C. goniognathus Bleeker, 1855, Thailand, Sumatra, freshwater
C. perakensis (Herre, 1936), Malaysia, freshwater.

Remarks : Teeth rarely occur at the sides of the lower jaw in clupeids (see Potamothrissa and Limnothrissa); equally rare are fang-like teeth on the pre-maxillae behind the normal outer series (see Cynothrissa).

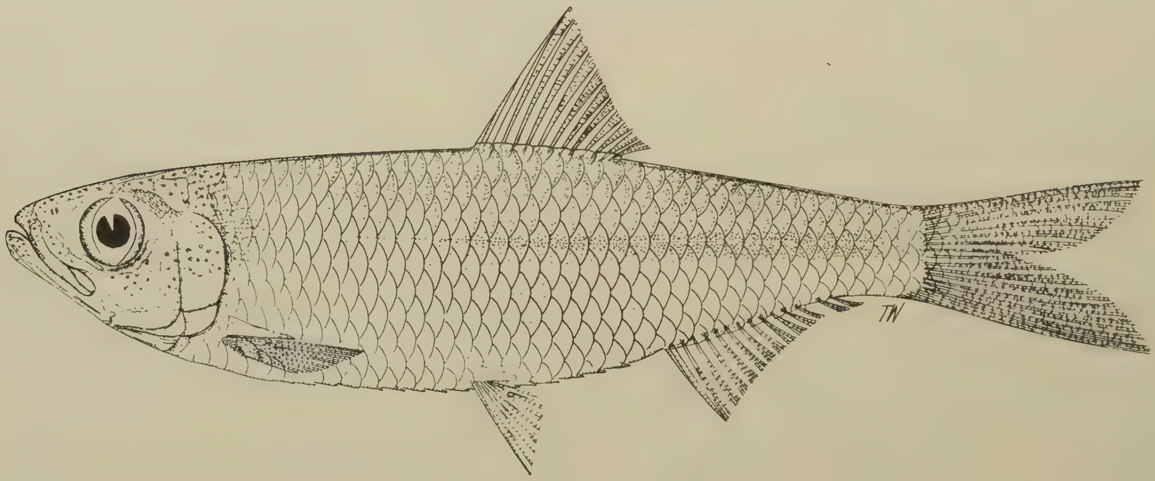
Clupeichthys aesarnensis Wongratana, 1983

CLUP Clupei 1

Clupeichthys aesarnensis Wongratana, 1983, Japan.J.Ichthyol., **29**(4):388, fig. 2 (Ubonrat reservoir, Konkhan, also Hualuang near Udon Thani and Lampoa reservoir, Karasint, Thailand).

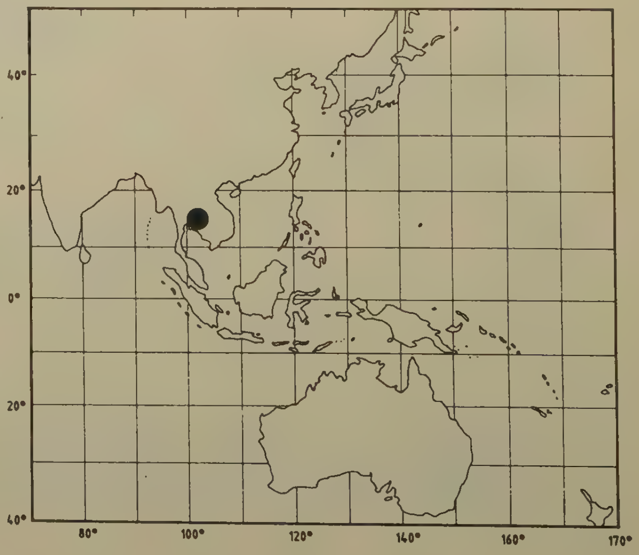
Synonyms : None.

FAO Names : En - Thai river sprat.



Diagnostic Features : Body moderately elongate, belly keeled, with 8 to 10 + 6 to 8 scutes. Snout blunt, pre-maxillae small and toothed, prominent teeth at symphysis and along sides of lower jaw; second supra-maxilla spatulate, about half length of maxilla blade. Lower gillrakers 17 to 19. Pectoral axillary scale less than half length of fin; pelvic finrays i 7; last two anal finrays forming a separate finlet. Resembles C. goniognathus (but lower gillrakers only 15 or 16), and C. bleekeri (but pectoral axillary scale more than half length of fin); C. perakensis has only i 6 pelvic finrays. Species of Corica also have a separate anal finlet, but the jaw teeth are small or minute and there are more lower gillrakers (19 to 27).

Geographical Distribution : Thailand (reservoir in northeastern part, Mekong drainage).



Habitat and Biology : Freshwater, in reservoirs, presumably also in rivers; more specimens and data needed.

Size : To 4.6 cm standard length.

Interest to Fisheries : Perhaps none.

Local Names : -

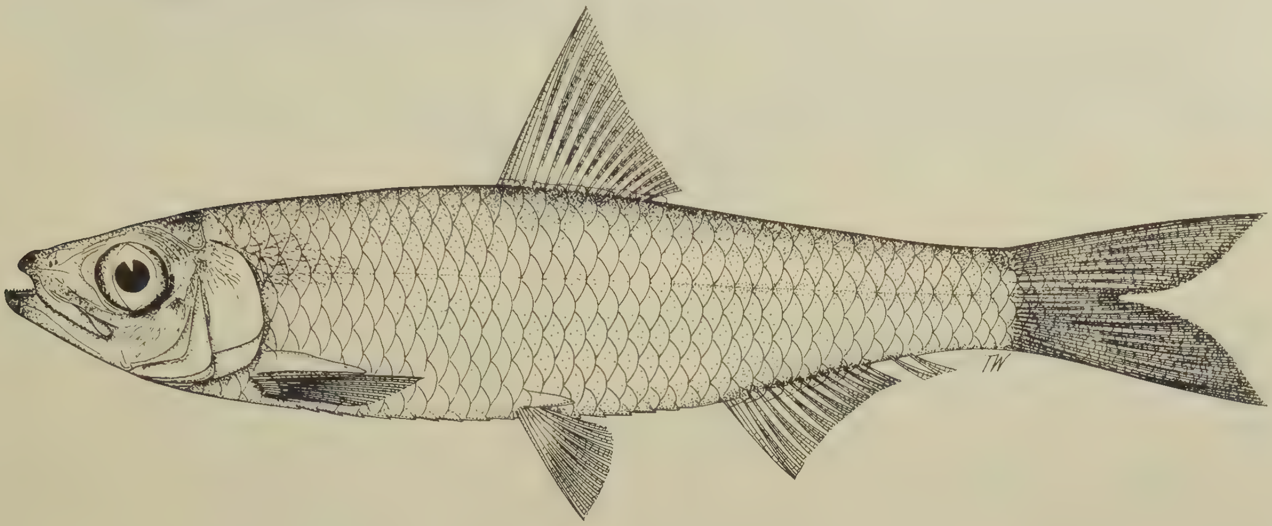
Clupeichthys bleekeri (Hardenberg, 1936)

CLUP Clupei 2

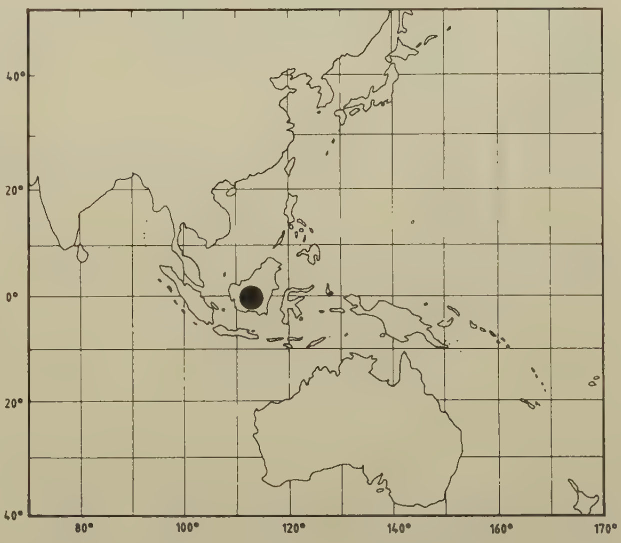
Corica bleekeri Hardenberg, 1936, Treubia, 15(3):229 (Kapuas River, Kalimantan).

Synonyms : Corica bleekeri:Fowler, 1941:646 (on Hardenberg); Clupeichthys bleekeri - Wongratana, 1980:99, pls 27, 28 (revision).

FAO Names : En - Kapuas river sprat.



Diagnostic Features : Body moderately elongate, belly keeled, with 9 or 10 + 7 or 8 scutes. Snout blunt, pre-maxillae small and bearing up to 4 teeth behind the outer series, prominent teeth at symphysis and along sides of lower jaw; second supra-maxilla spatulate, about half length of maxilla blade. Lower gillrakers 16 to 18. Pectoral axillary scale more than half length of fin; pelvic finrays i 7; last two anal finrays forming a separate finlet. Resembles C. aesarnensis (but pectoral axillary scale less than half length of fin) and C. goniognathus (same; also only 15 or 16 lower gillrakers); C. perakensis has only i 6 pelvic finrays. Species of Corica also have a separate anal finlet, but the jaw teeth are small or minute and there are more lower gillrakers (19 to 27).



Geographical Distribution : Indonesia (south-western Kalimantan, Kapuas River).

Habitat and Biology : Freshwater, in rivers; known from rather few specimens, more data needed.

Size : To about 6 cm standard length.

Interest to Fisheries : Perhaps none.

Local Names : -

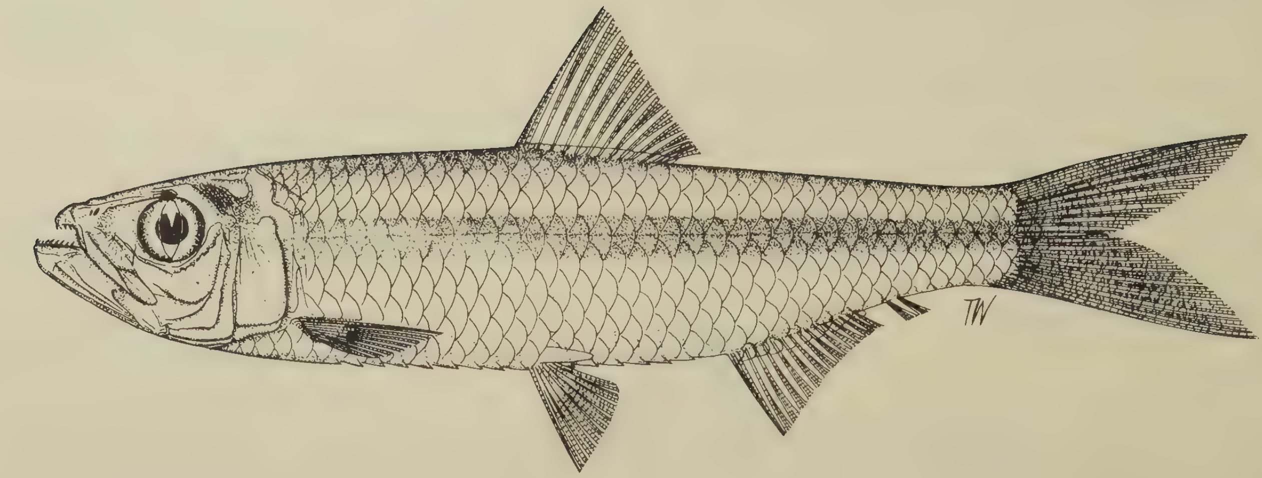
Clupeichthys goniognathus Bleeker, 1855

CLUP Clupei 3

Clupeichthys goniognathus Bleeker, 1855, Natuurk.Tijdschr.Ned.-Indië, 9:275 (Lahat, southern Sumatra).

Synonyms : Corica goniognathus:Weber & DeBeaufort, 1913:55, fig. 21 (mixed with C. bleekeri); Fowler, 1941:647 (on Weber & DeBeaufort); Clupeichthys goniognathus - Wongratana, 1980:101, pls 31, 32 (revision).

FAO Names : En - Sumatran river sprat.



Diagnostic Features : Body moderately elongate, belly keeled, with 9 or 10 + 7 or 8 scutes. Snout blunt, pre-maxillae small and toothed, prominent teeth at symphysis and along sides of lower jaw; second supra-maxilla spatulate, about half length of maxilla blade. Lower gillrakers 15 or 16. Pectoral axillary scale less than half length of fin; pelvic finrays i 7; last two anal finrays forming a separate finlet. Resembles C. bleekeri (but pectoral axillary scale more than half length of fin) and C. aesarnensis (but lower gillrakers 17 to 19); C. perakensis has only i 6 pelvic finrays. Species of Corica also have a separate anal finlet, but the jaw teeth are small or minute and there are more lower gillrakers (19 to 27).

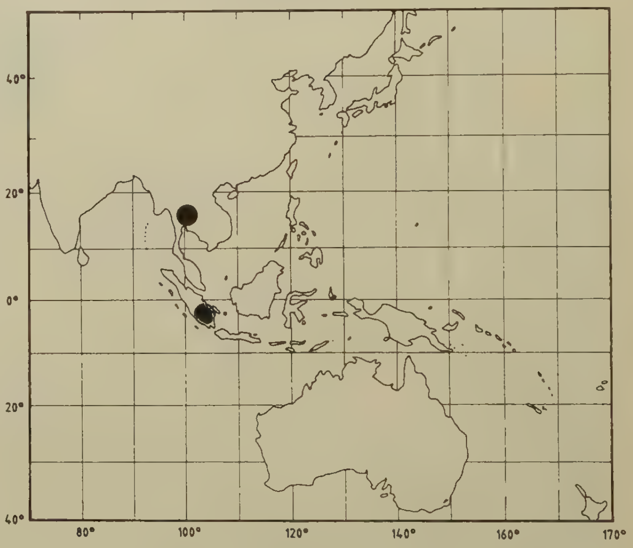
Geographical Distribution : Indonesia (southern Sumatra at Lahat, upper reaches of eastward flowing Musi system) and Thailand (at Ayudhya). Probably in other rivers, but the Kapuas records seem to refer to C. bleekeri.

Habitat and Biology : Freshwater, in rivers; known from rather few specimens, more data needed.

Size : To 6.6 cm standard length.

Interest to Fisheries : Probably none.

Local Names : -



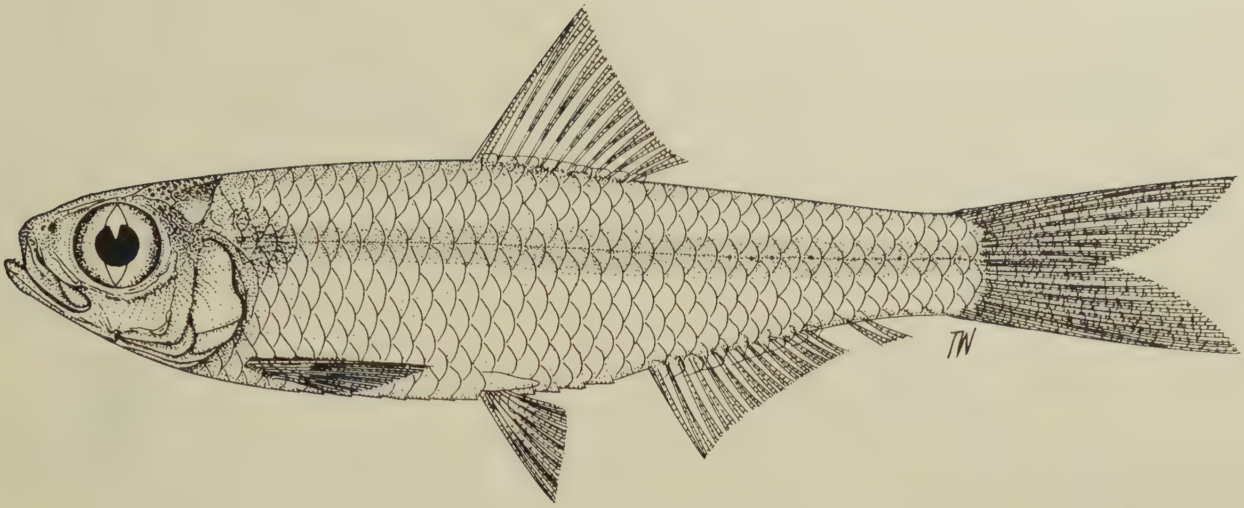
Clupeichthys perakensis (Herre, 1936)

CLUP Clupei 4

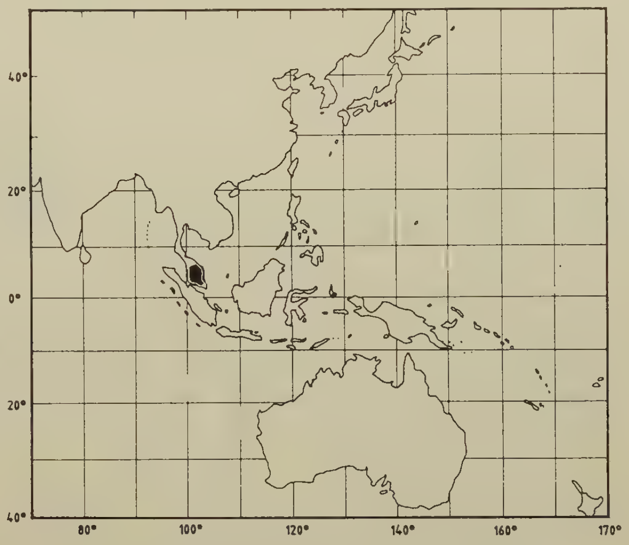
Corica perakensis Herre, 1936, Bull.Raffles Mus., (12):5, pl. 1 (Perak River, Malaysia).

Synonyms : Corica perakensis:Fowler, 1941:645 (on Herre); Clupeichthys perakensis - Wongratana, 1980:102, pls 33, 34 (revision).

FAO Names : En - Perak river sprat.



Diagnostic Features : Body moderately elongate, belly keeled, with 7 to 9 + 4 to 6 scutes. Snout blunt, pre-maxillae small and toothed, prominent teeth at symphysis and along sides of lower jaw; second supra-maxilla paddle-shaped, about half length of maxilla blade. Lower gillrakers 13 to 15. Pectoral axillary scale minute or absent; pelvic finrays i 6; last two anal finrays forming a separate finlet. Other Clupeichthys spp. have i 7 pelvic finrays, usually 15 or more total scutes (11 to 14 in C. perakensis) and a pectoral axillary scale at least 1/4 length of fin. Species of Corica also have a separate anal finlet, but the jaw teeth are small or minute and there are more lower gillrakers (19 to 27).



Geographical Distribution : Malaysia (Perak River).

Habitat and Biology : Freshwater, in rivers; known from only a few specimens, more data needed.

Size : To about 3 cm standard length, perhaps larger.

Interest to Fisheries : Probably none.

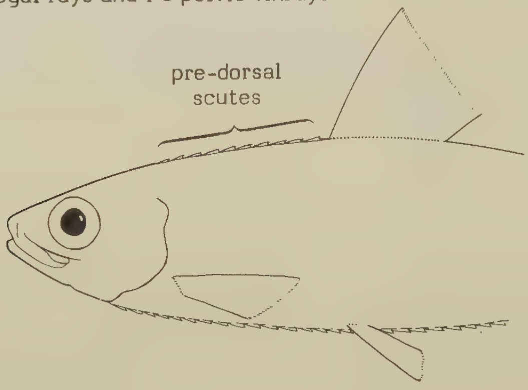
Local Names : -

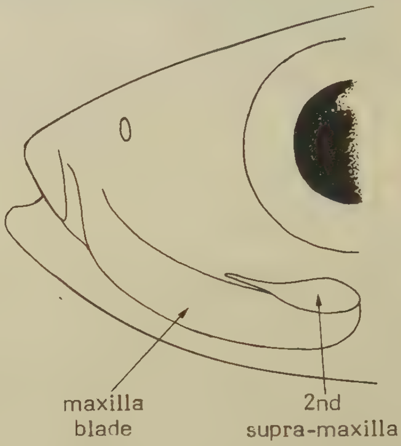
Potamalosa Ogilby, 1897

CLUP Potaml

Potamalosa Ogilby, 1897, Proc.Linn.Soc.N.S.W., **21**:504 (type: Potamalosa novaehollandiae of Ogilby, 1897 (not Meletta novaehollandiae Valenciennes, 1847, which is Sprattus) = Clupea richmondia Macleay, 1879).

Diagnostic Features : Relatively large Australian freshwater pellonulines reaching 20 cm standard length or more. Keeled scutes both before and behind pelvic fin base and a complete series of dorsal scutes from head to dorsal fin origin. Jaw teeth minute or absent; second supra-maxilla not as deep as maxilla blade. Branchiostegal rays 8. Pelvic finrays i 7. Juveniles resemble Hyperlophus, which has a deeper second supra-maxilla, only 4 branchiostegal rays and i 6 pelvic finrays.





Biology, Habitat and Distribution : Freshwater, in rivers of New South Wales and Victoria (Australia).

Interest to Fisheries : Of small local interest only.

Species : A single species recognized:

P. richmondia (Macleay, 1879), southwestern Australia.

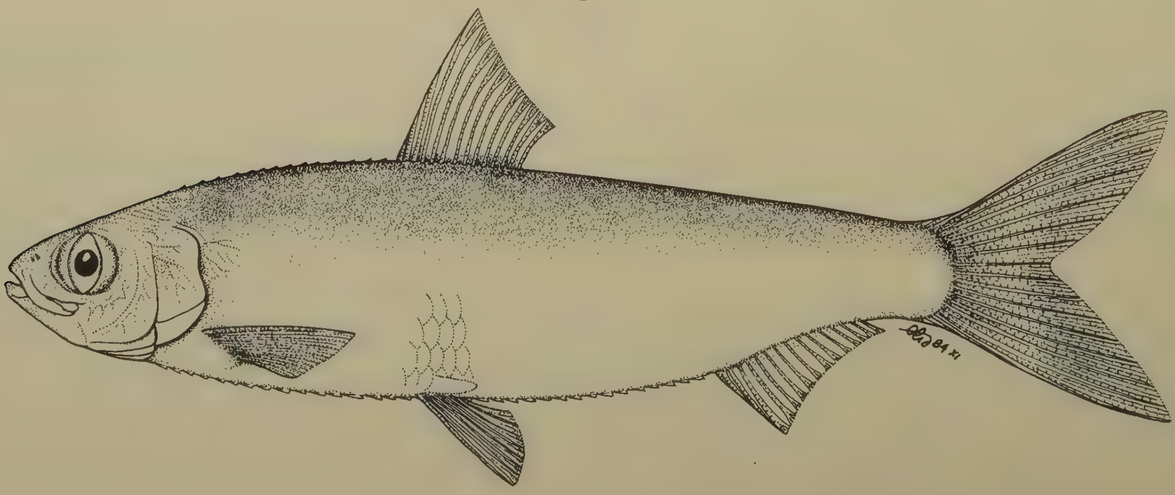
Potamalosa richmondia (Macleay, 1879)

CLUP Potaml 1

Clupea richmondia Macleay, 1879 (1 December), Proc.Linn.Soc.N.S.W., **4**(3):380 (Richmond River, New South Wales).

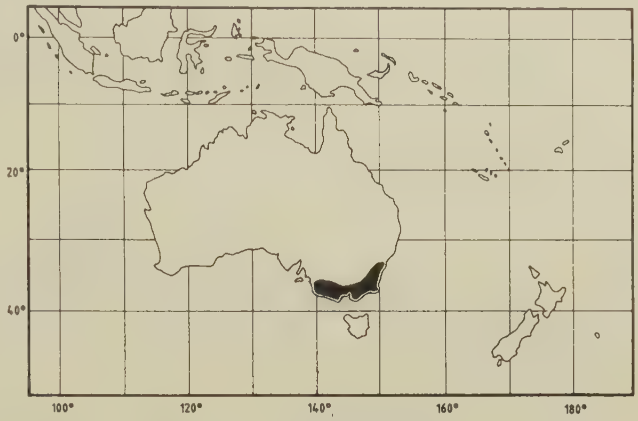
Synonyms : Clupea novaehollandiae:Günther, 1868:431 (Hawkesbury River, New South Wales; not novaehollandiae of Valenciennes, 1847, which is Sprattus); Potamalosa antiqua Ogilby, 1897 (Nepean River); Potamalosa novaehollandiae:Roughley, 1916:17 (biol., distr.); Potamalosa richmondia - McCulloch, 1929:40 (synonymy); Fowler, 1941:641 (Nepean, Hunter and Richmond Rivers, New South Wales; 2 Fiji specimens questionably labelled as such); Munro, 1956:24, fig. 167 (New South Wales and Victoria); Whitehead & Bauchot, in press (syntype of Potamalosa antiqua).

FAO Names : En - Australian freshwater herring.



Diagnostic Features: Body fairly elongate, belly keeled, with 16 to 18 + 14 or 15 scutes; about 14 dorsal scutes with low keel from head to dorsal fin origin. Minute or no teeth in jaws; second supra-maxilla slender. Branchiostegal rays 8. Pelvic finrays i 7; anal fin origin far behind dorsal fin base. For distinction from *Hyperlophus vittatus* and *H. translucidus*, see genus.

Geographical Distribution: Southeastern Australia (Hunter, Hawkesbury, Nepean and other rivers of New South Wales and Victoria).



Habitat and Biology: Freshwater, in middle and upper parts of rivers, migrating down into estuaries to breed in July/August. Feeds on prawns, worms and insects.

Size: To 20 cm standard length, perhaps more.

Interest to Fisheries: Taken in nets during spawning season (July/August); will also take bait. Catches small.

Local Names:

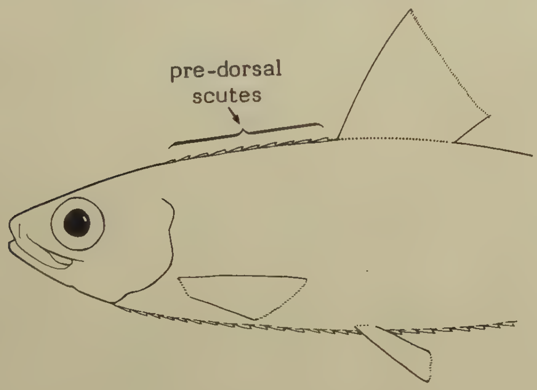
Literature: Roughley (1916 - general biology).

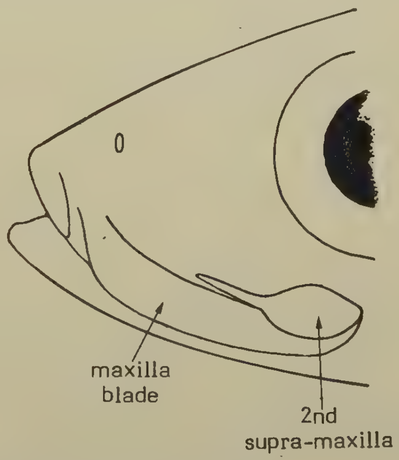
Hyperlophus Ogilby, 1892

CLUP Hyper

Hyperlophus Ogilby, 1892, *Rec.Aust.Mus.*, **2**(2):26 (type: *Clupea spratellides* Ogilby, 1892 = *Meletta vittata* Castelnau, 1875). *Omochetus* Ogilby, 1897, *Proc.Linn.Soc.N.S.W.*, **22**:72 (type: *Hyperlophus copii* Ogilby, 1897 = *Meletta vittata* Castelnau, 1875). *Hyalosprattus* Whitley, 1936, *Mem.Qd Mus.*, **11**(1):25 (type: *Hyperlophus translucidus* McCulloch, 1917).

Diagnostic Features: Small Australian coastal or estuarine pellonulines reaching about 8 cm standard length. Keeled scutes both before and behind pelvic fin base and a complete series of dorsal scutes from head to dorsal fin origin. Jaw teeth minute or absent; second supra-maxilla deeper than maxilla blade. Branchiostegal rays only 4. Pelvic finrays i 6. Resembles small *Potamalosa*, which has a more slender second supra-maxilla, 8 branchiostegal rays and i 7 pelvic finrays.





Biology, Habitat and Distribution: Bays and estuaries of the southern coasts of Australia.

Interest to Fisheries: Sold as bait.

Species: Two species, overlapping in part of their ranges:

H. translucidus McCulloch, 1917, southern Australia
H. vittatus (Castelnau, 1875), southern Australia.

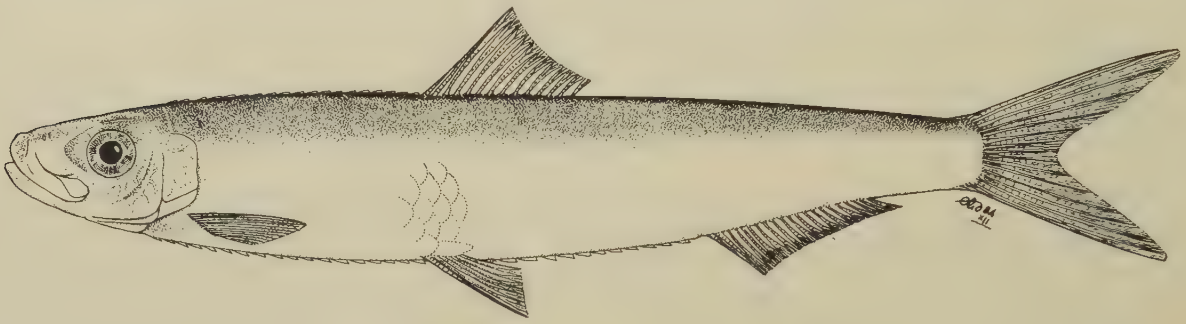
Hyperlophus translucidus McCulloch, 1917

CLUP Hyper 1

Hyperlophus translucidus McCulloch, 1917, Rec.Aust.Mus., **11**(7):165, pl. 29, fig. 3 (Sans Souci, Botany Bay, New South Wales).

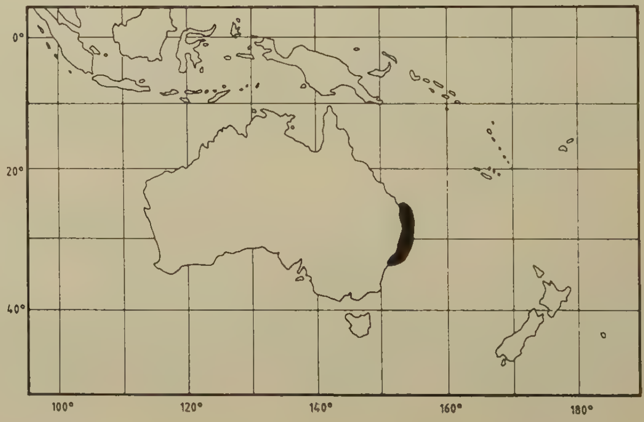
Synonyms : Hyperlophus translucidus - McCulloch, 1929:40 (synonymy); Fowler, 1941:643 (on McCulloch); Munro, 1956:24, fig. 169 (New South Wales, Queensland); Yabumoto & Uyeno, 1981:69, figs 3, 4, 7 (skeleton).

FAO Names : En - Transparent sandy sprat.



Diagnostic Features : Body fairly elongate, belly keeled, with 17 + 9 scutes; about 19 dorsal scutes with low keels from head to dorsal fin origin. No teeth in jaws; second supra-maxilla paddle-shaped, lower portion larger. Branchiostegal rays 4. Anal fin origin under or only slightly behind base of last dorsal finray (well behind in H. vittatus). Scales deciduous; body translucent, with silver band along flank. Dorsal scutes also present in Potamalosa richmondia, but anal fin much further back.

Geographical Distribution : New South Wales and Queensland (26°48'S to 33°59'S).



Habitat and Biology : Shallow sandy parts of bays and estuaries, perhaps tolerating lowered salinities.

Size : To about 6 cm standard length.

Interest to Fisheries : None.

Local Names : -

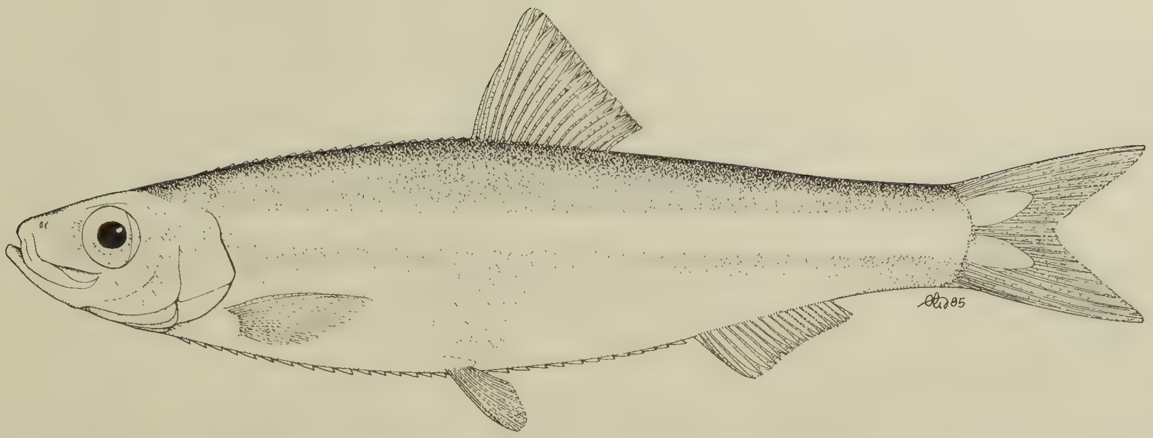
Hyperlophus vittatus (Castelnau, 1875)

CLUP Hyper 2

Meletta vittata Castelnau, 1875, Res.Fish.Austr.Philad.Cent.Exhib., Intercol.Exhib.Essays, Vict.Dept., Melbourne, (2):46 (Melbourne, Victoria).

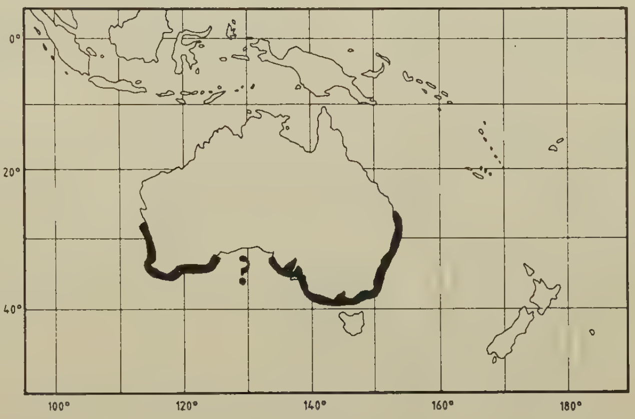
Synonyms : Clupea sprattellides Ogilby, 1892:24 (Parramatta River, New South Wales); Hyperlophus (Omochetus) copii Ogilby, 1897:72 (Maroubra, New South Wales); Hyperlophus vittatus - McCulloch, 1929:40 (synonymy); Fowler, 1941:642 (New South Wales); Munro, 1956:24, fig. 168 (Western Australia to New South Wales, also Queensland); Scott, Glover & Southcott, 1973:69, fig. (all Australian states except Tasmania); Yabumoto & Uyeno, 1981:69, figs 1, 2, 4-7 (skeleton); Hutchins & Thompson, 1983:18, 75, fig. 53 (Kalbarri, Western Australia to New South Wales); Whitehead & Bauchot, in press (syntypes in Paris).

FAO Names : En - Sandy sprat.



Diagnostic Features : Body fairly elongate, belly keeled, with 19 to 24 - 10 to 13 scutes; 23 to 27 dorsal scutes with low keels from head to dorsal fin origin. No teeth in jaws; second supra-maxilla paddle-shaped, lower portion larger. Branchiostegal rays 4. Anal fin origin an eye diameter or more behind base of last dorsal finray (under or only just behind in H. translucidus). Scales more or less firm on body; a silvery band along flank. Dorsal scutes also present in Potamalosa richmondia, but pelvic finrays i 7 (i 6 in Hyperlophus) and branchiostegal rays 8.

Geographical Distribution : Southern coasts of Australia (Kalbarri at 27°30'S in Western Australia to South Australia, New South Wales and Moreton Bay, Queensland; not Tasmania).



Habitat and Biology : Schools in large numbers in shallow sandy areas of bays and estuaries.

Size : To about 10 cm standard length.

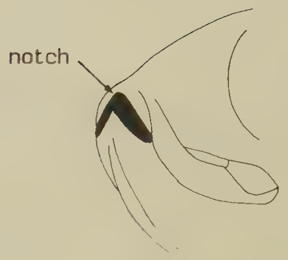
Interest to Fisheries : Sold as whitebait and used as a popular bait by anglers in Western Australia.

Local Names : AUSTRALIA: Whitebait.

Literature : Scott, Glover & Southcott (1973); Hutchins & Thompson (1983 - general notes, figures).

2.2.4 SUBFAMILY ALOSINAE

FAO Names : En - Shads.



Diagnostic Features : Moderate to large or (for clupeoids) very large herring-like fishes (to 60 cm standard length, usually about 20 to 30 cm; fully scuted along belly, scutes also present along back before dorsal fin in some (Ethmidium). Upper jaw not evenly rounded in front, but with a distinct notch into which the symphysis of the lower jaw fits; jaw teeth reduced or absent. Dorsal fin at about midpoint of body, pelvic fins below, anal fin short and well behind dorsal fin base; pelvic finrays i 6 to 8. Scales usually well attached. Stomach muscular in some. Often a dark spot posterior to gill opening and in some species a series of similar spots along flank (or even a second row below this).

Biology, Habitat and Distribution : The Alosinae are marine, pelagic, estuarine or freshwater fishes, with some species (or subspecies or races) anadromous, semi-anadromous or totally freshwater (rivers and lakes). All are schooling fishes, and most or all are migratory (except where landlocked). Food includes fishes and various invertebrates, but a few are filter-feeders on phytoplankton (e.g. Ethmalosa). A number of shads contribute significantly to fisheries, especially species of Brevoortia, Alosa and Tenualosa.

Remarks : Regan (1917) and some later authors have strongly deplored separation of the shads from the gizzard shads (subfamily Dorosomatinae) and there is some evidence that neither subfamily is in itself homogenous (i.e. that all species have a common ancestor). For the present, however, it is convenient to retain the traditional classification.

There are 7 genera (2 Europe and western Atlantic, 1 West Africa, 3 Indo-Pacific and 1 eastern Pacific) and 31 species, the largest concentration of species (also subspecies) being the European and western Atlantic Alosa (15 species or nearly half of all the shads).

Key to the Genera :

1a. Upper gillrakers of first gill arch (when numerous) overlapping the lower gillrakers at angle of arch (Fig. 1); pelvic finrays i 6 or i 8; Europe, western Atlantic, eastern Pacific

  2a. No pre-dorsal scutes; gillrakers present on posterior face of third epibranchial (Fig. 2)

    3a. Pelvic finrays i 8; normal scales along back before dorsal fin; body scales normal, not deeply overlapping; Europe, western and eastern Atlantic .... **Alosa**

    3b. Pelvic finrays i 6; paired scales along back before dorsal fin enlarged, fringed (Fig. 3); body scales deeply overlapping; western Atlantic only .... **Brevoortia**

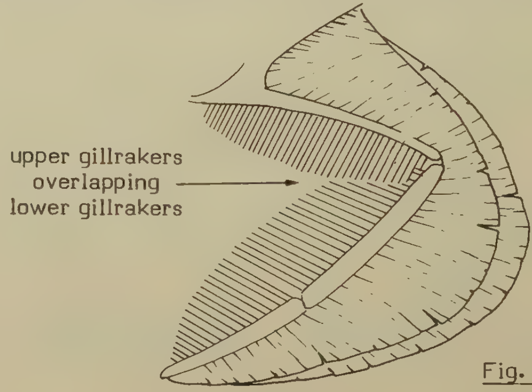


Fig. 1

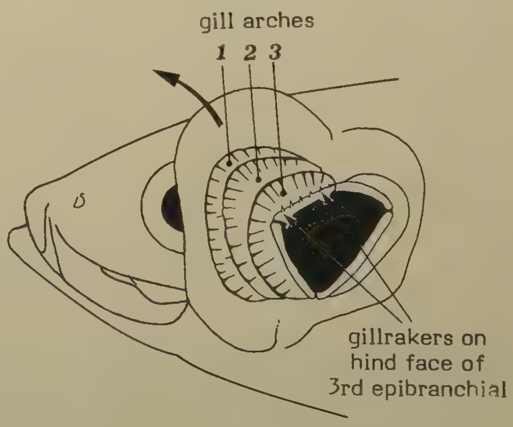
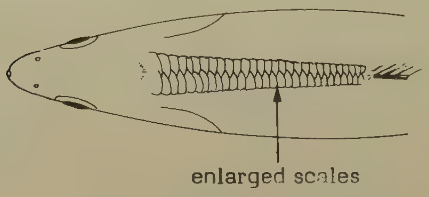


Fig. 2



Brevoortia

Fig. 3

2b. Pre-dorsal scutes present (Fig. 4); no gillrakers on posterior face of third epibranchial; pelvic finrays i 6; eastern Pacific only .... **Ethmidium**

1b. Upper gillrakers of first gill arch not overlapping the lower gillrakers at angle of arch; pelvic finrays i 7; West Africa and Indo-Pacific

4a. West Africa only; gillrakers very numerous, upper gillrakers strongly bent, V-shaped .... **Ethmalosa**

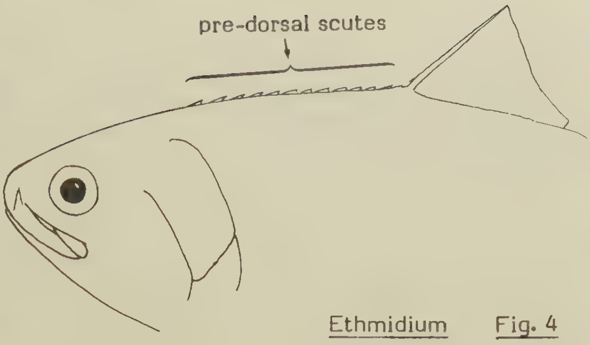
4b. Indo-Pacific only; upper gillrakers normal or curled outward

5a. Scales large, evenly arranged, 37 to 47 in lateral series; marine or anadromous

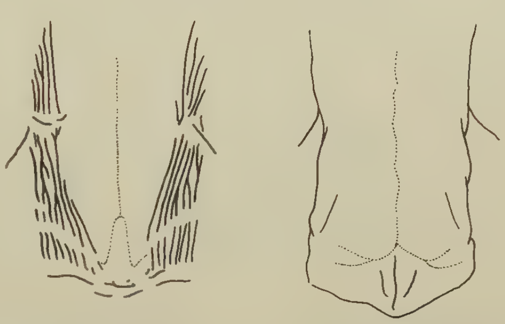
6a. Fronto-parietal striae (on top of head) many, 8 to 14 (Fig. 5a); gillrakers on inner arches distinctly curled outward; scales perforated .... **Hilsa**

6b. Fronto-parietal striae weakly developed, usually hidden by skin (Fig. 5b); gillrakers on inner arches straight; scales not perforated ..... **Tenualosa**

5b. Scales small, series irregular except on upper flank, 77 to 91 in lateral series; freshwater only .... **Gudusia**



Ethmidium Fig. 4



a. Hilsa b. Tenualosa

fronto-parietal striae Fig. 5

Alosa Linck, 1790

CLUP Alos

Alosa Linck, 1790, Neuestes Mag.Phys.Naturgesch., **6**(3):35 (type: no species included, but Clupea alosa Linnaeus, 1758 by tautonomy). Pomolobus Rafinesque, 1820 (April) Western Review Misc.Mag., **2**(3):170 and 1820 (December), Ichthyol.Ohiensis:38 (type: Pomolobus chrysochloris Rafinesque, 1820, but see comment by Hildebrand, 1964:315, footnote). Alausa Valenciennes, 1847, Hist.nat.poiss., **20**:389 (type: Alausa vulgaris Valenciennes, 1847 = Clupea alosa Linnaeus, 1758) (apparently a variant spelling of Alosa). Alausella Gill, 1861, Proc.Acad.nat.Sci.Philad., Suppl.:54 and Ibid.:36 (type: Clupea parvula Mitchill, 1814 = probably Clupea pseudoharengus Wilson, 1811, juvenile). Caspialosa Berg, 1915, Mater.pozn.russ.rybol., **4**(6):4 (type: Clupea caspia Eichwald, 1838). Paralosa Roule, 1925, Poiss.Eaux douce France:73 (type: Clupea fallax Lacepède, 1803) (preoccupied by Paralosa Bleeker, 1868 = Sardinella; also by Paralosa Regan, 1916 = Hilsa).

Diagnostic Features: Moderate or large herring-like fishes (to 60 cm standard length), somewhat compressed, with a fairly prominent keel of scutes along the belly. Upper jaw with a distinct median notch. Upper gillrakers, when numerous, folding down over lower gillrakers at angle of first arch; total gillrakers (upper plus lower) from 30 to as many as 130. Pelvic finrays i 8. Scales normal, hind borders smooth, no enlarged and fringed scales along back before dorsal fin (cf. Brevoortia). The notched upper jaw and long upper gillrakers separates Alosa from similar sympatric genera (Clupea, Sardina, Sardinella, etc.).

Biology, Habitat and Distribution: Marine, pelagic, mostly anadromous or semi-anadromous, but some purely freshwater species (subspecies or races); schooling, migratory (except where landlocked). Feed on small fishes and invertebrates, also phytoplankton in species with numerous gillrakers. Mediterranean, Black Sea, Sea of Azov, Caspian, and eastern and western North Atlantic (introduced into North Pacific).

Interest to Fisheries : Species of Alosa contributed 25 663 tons in 1983, mainly from American Atlantic waters (82%).

Species : Earlier authors considered Alosa, Caspialosa and Pomolobus as distinct genera; Svetovidov (1964) united them, but kept Pomolobus as a subgenus of Alosa (sympatric in western North Atlantic). Species of 'Caspialosa' are Ponto-Caspian in distribution and only meet 'true' Alosa in the associated rivers and lakes of the northern part of the Aegian Sea. To help identification, the 15 species of Alosa are listed geographically:

Eastern Atlantic, Mediterranean

A. alosa (Linnaeus, 1758), eastern Atlantic, Mediterranean
A. fallax (Lacepède, 1803), eastern Atlantic Mediterranean

Ponto-Caspian

A. pontica (Eichwald, 1838), Black Sea, Sea of Azov
A. maeotica (Grimm, 1901), Black Sea, Sea of Azov
A. caspia (Eichwald, 1838), Caspian, also Black Sea, Sea of Azov
A. brashnikovi (Borodin, 1904), Caspian
A. saposhnikovi (Grimm, 1887), Caspian
A. sphaerocephala (Berg, 1913), Caspian
A. kessleri (Grimm, 1887), Caspian (anadromous)

Western Atlantic

A. aestivalis (Mitchill, 1814), western North and central Atlantic
A. alabamae Jordan & Evermann, 1896, western central Atlantic
A. chrysochloris (Rafinesque, 1820), western central Atlantic
A. mediocris (Mitchill, 1814), western North and central Atlantic
A. pseudoharengus (Wilson, 1811), western North and central Atlantic
A. sapidissima (Wilson, 1811), western North and central Atlantic.

Remarks : The taxonomy of the European shads, and especially the Ponto-Caspian species, still requires much work. In the absence of fully diagnostic morphometric or meristic characters, biochemical analysis may be the best solution, especially in resolving questions of subspecies.

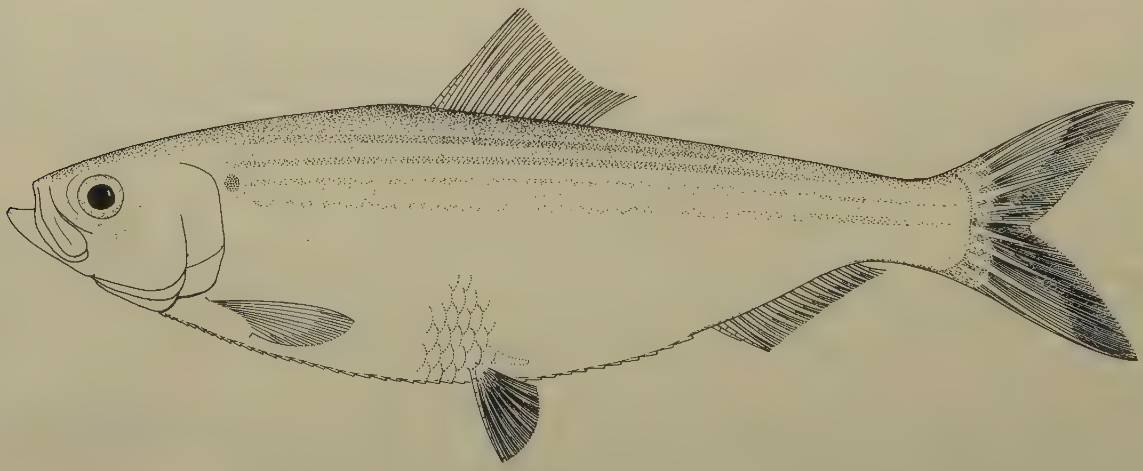
Alosa aestivalis (Mitchill, 1814)

CLUP Alos 1

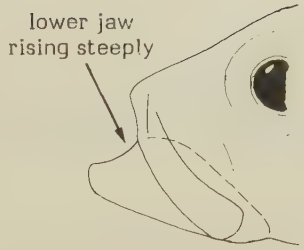
Clupea aestivalis Mitchill, 1814, Fishes New York:21 (New York).

Synonyms : ? Clupea fasciata LeSueur, 1818:233 (Sandwich, Massachusetts); ? Pomolobus cyanonoton Storer, 1848:242 (presumed Massachusetts); Pomolobus aestivalis:FWNA, 1964:324, fig. 80, also fig. 81 (growth stages) (full synon., descr., biol.); Alosa aestivalis - Liem & Scott, 1966:87, fig. (poor) (synopsis).

FAO Names : En - Blueback shad.



Diagnostic Features: Body fusiform, moderately compressed, belly with distinct keel of scutes. Lower jaw rising steeply within mouth; minute teeth present at front of jaws (disappearing with age), no teeth on vomer. Lower gillrakers 41 to 52 (fewer in fishes under 10 cm standard length), slender. Back dark blue, sometimes bluish-grey; a dark spot on shoulder. Resembles A. pseudoharengus in number of gillrakers and steeply rising lower jaw, but that species has the eye usually larger than snout length, the peritoneum silvery (cf. dark) and the back greyish-green. Other shads have a gently rising lower jaw and more (59 to 73) or fewer (18 to 24) lower gillrakers or occur only in the Gulf of Mexico (A. alabamae). See CLUP Alos 1, Fishing Area 31.



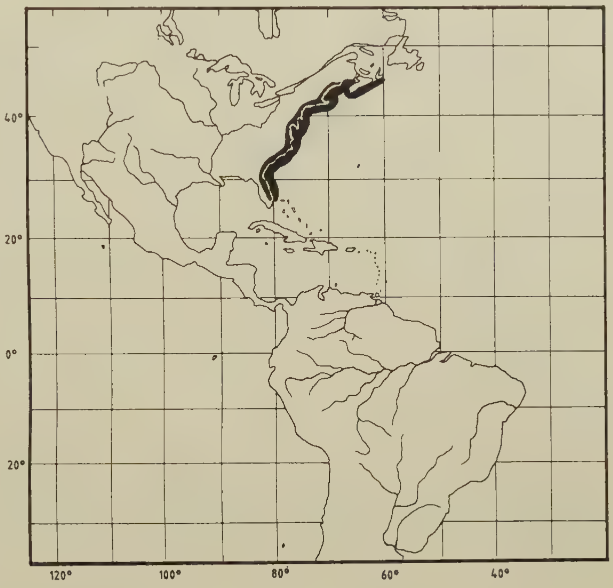
Geographical Distribution: North America (Atlantic coasts from Cape Breton, Nova Scotia south to the St. John's River, Florida, also in lower parts of rivers).

Habitat and Biology: Euryhaline, anadromous, possibly wintering near the bottom and out from the coast, approaching the shore in late spring. Feeds on small fishes, copepods, small shrimps. Spawns in brackish- or freshwaters of rivers, having arrived in coastal waters a month or so later than A. pseudoharengus (Chesapeake Bay in April, apparently when the water is above 70°C; later further north); the young descend in autumn (Chesapeake Bay in October/November).

Size: To about 38 cm standard length, usually about 25 to 30 cm.

Interest to Fisheries: Probably not distinguished from A. pseudoharengus in northern part of range, but catches in south negligible (128 tons in 1974; not recorded in 1983).

Local Names: CANADA: Blueback herring; USA: Blueback herring (AFS list).



Literature: Hildebrand (i.e. FWNA, 1964 - USA, biol., etc.); Liem & Scott (1966 - Canada, synopsis).

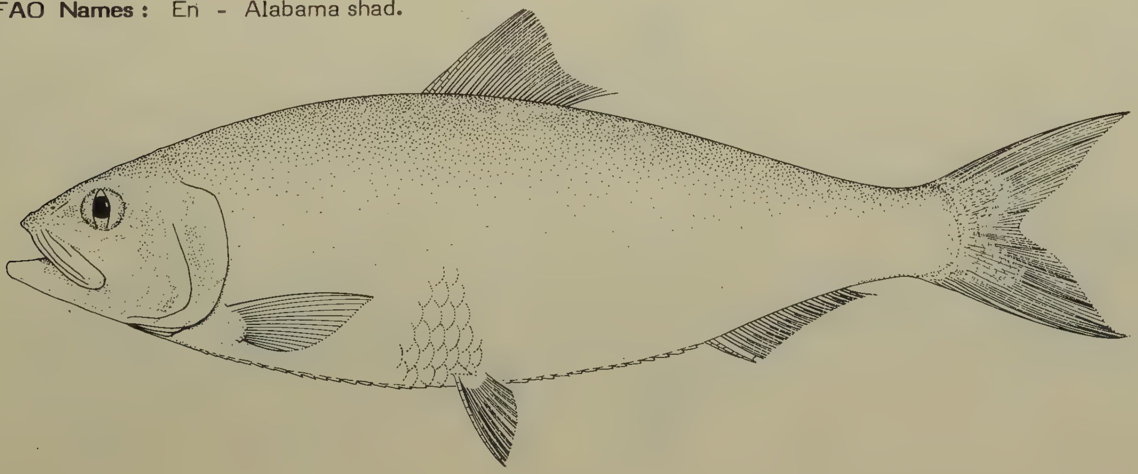
Alosa alabamae Jordan & Evermann, 1896

CLUP Alos 2

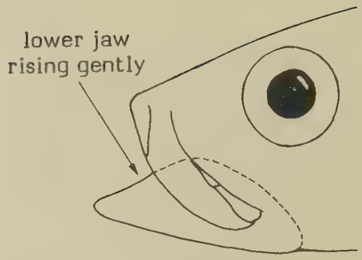
Alosa alabamae Jordan & Evermann, in Evermann, 1896, Rep.U.S.Commnr Fish, (21):203 (Black Warrior River, Tuscaloosa, Alabama).

Synonyms: Meletta suoerii Valenciennes, 1847:375 (Wabash River, Illinois; nomen oblitum); Alosa ohiensis Evermann, 1902:figs 1, 2 (Ohio River, Louisville, Kentucky); Alosa alabamae - Regan, 1916:7 (key), 9 (descr., subspecies A. alabamae ohiensis); FWNA, 1964:308, fig. 75 (full synon., descr., biol.); Whitehead, 1967:84 (types of Meletta suoerii); Whitehead & Bauchot, in press (same; see Remarks).

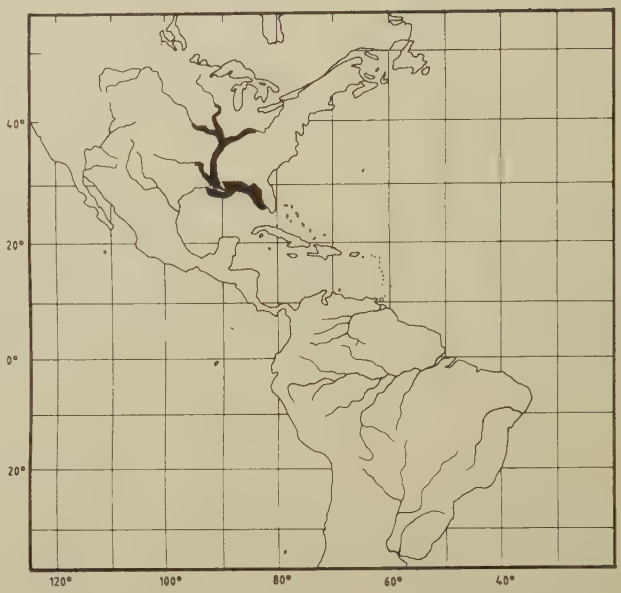
FAO Names: En - Alabama shad.



Diagnostic Features : Body fusiform, moderately compressed, belly with distinct keel of scutes. Lower jaw not rising steeply within mouth; no teeth present at front of jaws, no teeth on vomer. Lower gillrakers 41 to 48 at 30 cm standard length or more. The only other shad of the Gulf of Mexico, A. chrysochloris, has only 20 to 24 gillrakers. Closely resembles A. aestivalis and A. pseudoharengus of Atlantic coasts, but in them the lower jaw rises very steeply in the mouth. See CLUP Alos 2, Fishing Area 31.



Geographical Distribution : Gulf of Mexico (northern part, from the Mississippi delta eastward to the Choctawhatchee River in Florida; also in rivers from Iowa to Arkansas and across to West Virginia).



Habitat and Biology : Euryhaline, anadromous. Food (no data given in FWNA, 1964). Spawns in freshwater in spring or early summer, ascending rivers and streams, the young presumably descending in autumn.

Size : To 51 cm standard length, usually about 40 to 45 cm.

Interest to Fisheries : Only small catches in the past.

Local Names : USA: Gulf shad, Ohio shad.

Literature : Hildebrand (i.e. FWNA, 1964 - biol., etc.).

Remarks : The lectotype of Meletta suoerii (a juvenile) has 33 lower gillrakers, thus cannot be A. chrysochloris as supposed by Hildebrand (1964, i.e. FWNA). However, the name has not been used for either species.

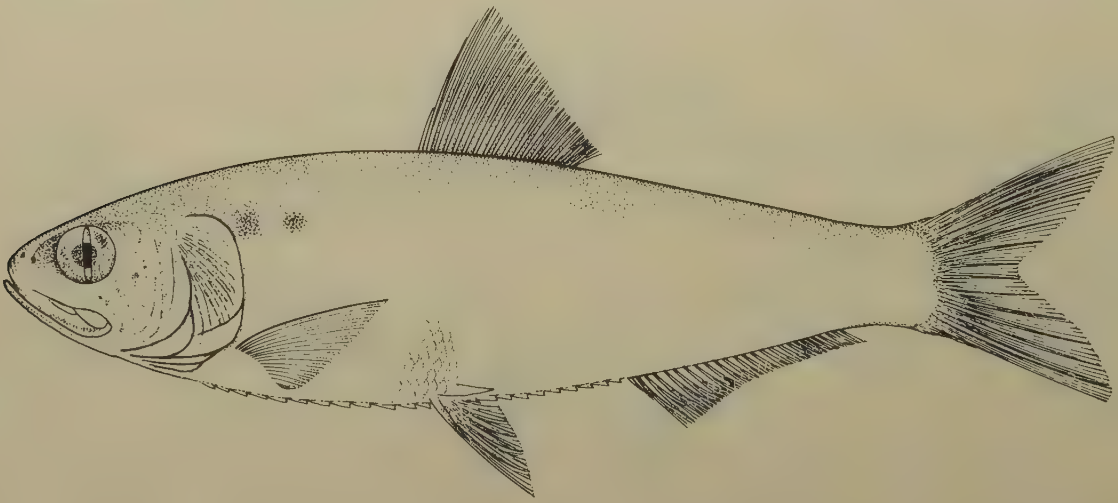
Alosa alosa (Linnaeus, 1758)

CLUP Alos 5

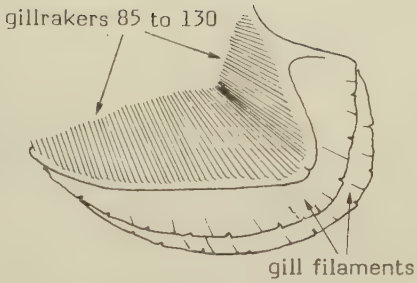
Clupea alosa Linnaeus, 1758 Syst.nat., 10th ed.:318 (in 'Oceano Europaeo').

Synonyms : Alosa communis Yarrell, 1836:136 (Thames and Severn Rivers); Alausa vulgaris Valenciennes, 1847:391, pl. 604 (Europe, North Africa); Alosa cuvieri Malm, 1877:154 (Bordeaux); Alosa alosa - Svetovidov, 1952:312, pl. 25, fig. 1 (but not A. alosa bulgarica = A. caspia); Idem, 1963:351, pl. 25, fig. 1 (same); Wheeler, 1969:70, fig. (synopsis); CLOFNAM, 1973:105 (synonymy); Wheeler, 1978:70, fig. (synopsis); FNAM, 1984:269, fig. (synopsis); CLOFETA in press (synonymy).

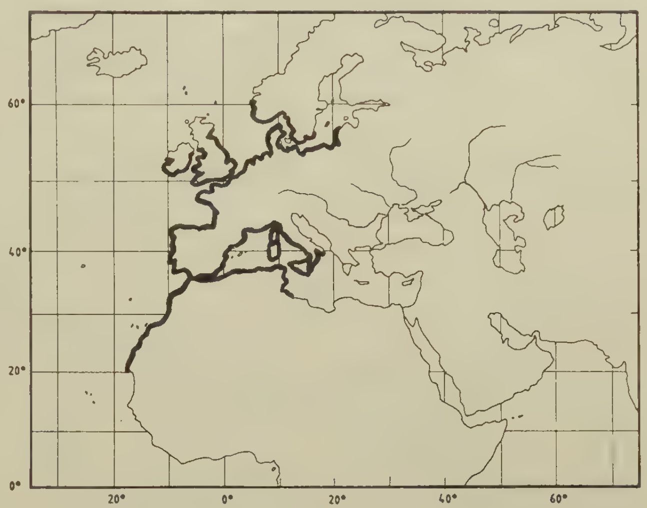
FAO Names : En - Allis shad.



Diagnostic Features : Body somewhat compressed, fairly deep (depth at pectoral fin more than head length), scutes apparent along belly. Upper jaw notched, lower jaw fitting into it; no teeth on vomer. Gillrakers long, thin and numerous, total 85 to 130, longer than gill filaments. A dark spot posterior to gill opening (sometimes absent; occasionally 1 or 2 more spots). Resembles A. fallax, which has fewer and shorter gillrakers (total 30 to 80) and 7 or 8 black spots along flank. See CLUP Alos 5, Fishing Areas 34, 47 (in part).



Geographical Distribution : Coasts of Europe, from about Bergen to northern Mauritania (but not in Baltic), also western part of Mediterranean.



Habitat and Biology : Marine, pelagic, schooling and strongly migratory, penetrating far up rivers (but not into small tributaries). Enters rivers in spring to spawn in May, usually at night and where the current is swift, the adults returning to the seas afterward; juveniles pass down to the sea in autumn. Feeds on a wide range of planktonic crustaceans; larger adults feed on small schooling fishes. Less common than A. fallax, but both have suffered from pollution and weirs or other obstructions.

Size : To 60 cm standard length and 2.7 kg.

Interest to Fisheries : Palatable, but bony. Not always separated from A. fallax in fishery records; the combined catch for both species in 1983 was only 971 tons (Morocco, France, Romania, Turkey).

Local Names : DENMARK: Majsild; GERMANY: Maifisch; NORWAY: Maifisk; THE NETHERLANDS: Groote meifisch; UK: Mayfish.

Literature : Wheeler (1969, 1978 - synopsis); FNAM (1984 - synopsis).

Remarks : Alosa africana Regan, 1916 from Algeria is not a distinct subspecies, but a hybrid between A. alosa and A. fallax (Furnestin & Vincent, 1958). Alosa macedonica Vinciguerra, 1921, is also not a subspecies of A. alosa (see under Alosa caspia).

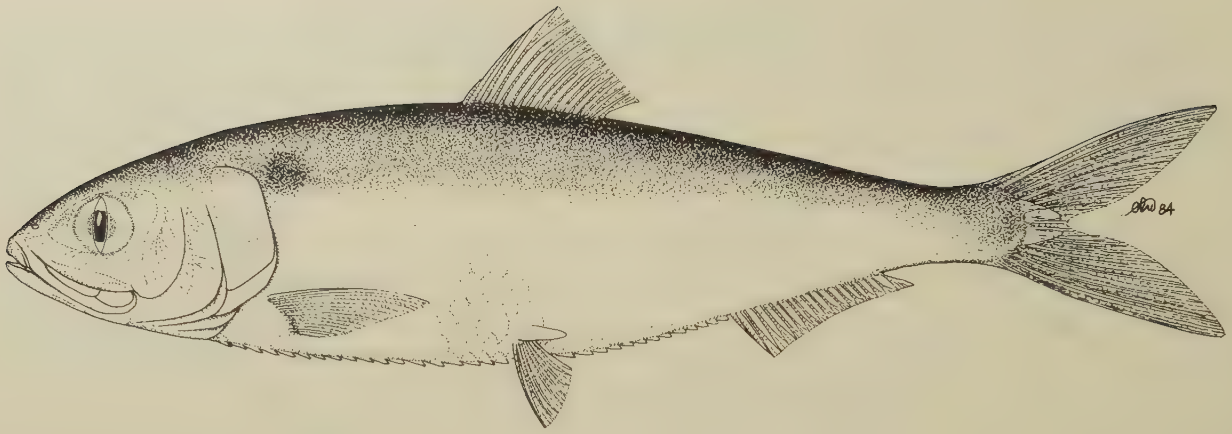
Alosa brashnikovi (Borodin, 1904)

CLUP Alos 8

Clupea caspio-pontica var. brashnikovi Borodin, 1904, Vestnik Rybopromyshlennosti, **19**(3):176, 180, 182-183, 184-185, fig. 2 (in part: Aleksandrovsk Nos 1-15, Krasnovodsk Nos 25-26, 28-33; Fort Shevenko chosen).

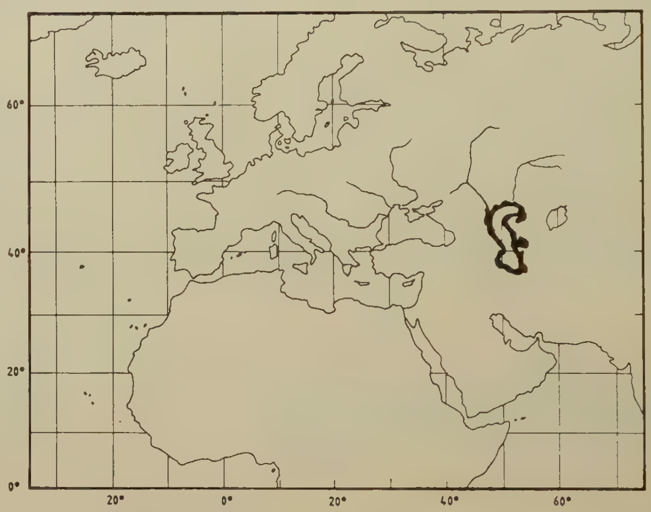
Synonyms : Clupea caspio-pontica var. grimmi Borodin, 1904:180, 184 (Ashur-ade, near Astrabad Bay, Caspian); Clupea (Alosa) curensis Suvarov, 1907:165, 192-194, fig. 4 (opp. mouth of Kura River, and near Kziligach Bay, Caspian); Clupeonella leucocephala Berg, 1913:27, pl. 14, figs 1, 2 (Sumgait and Gyurgenchai at Belidzhi Station, Caspian); Caspialosa brashnikovi autumnalis Berg, 1915:5, 6, pl. 1, fig. 2, pl. 2, fig. 3 (Cheleken Island, Krasnovodsk, Lenkoran, Kizilagach Bay opposite Samur River mouth at Tyulenii Island, Caspian); Caspialosa caspia nigra Kisselevitch, 1923:115, 139-140 (Bay or Mertvi Kultuk, Caspian; also included specimens of A. saposhnikovi); Caspialosa kisselevitshi Bulgakov, 1926:27, pl. 2 (Gasan-uli, Caspian); Caspialosa nirchi Morosov, 1928:73 (Krasnovodsk Bay, Caspian); Caspialosa brashnikovi kenderlensis Budamshin, 1938:36 (Kendyrli Bay, Caspian); Caspialosa brashnikovi orientalis Mikhailovskaya, 1941:560 (eastern coast of southern Caspian north to Kenderyli Bay); Caspialosa brashnikovi agrachanica Mikhailovskaya, 1941:559 (southern part in winter, spawning in northern part at Tyulenii and Darga Islands in summer, Caspian; earlier descriptions on Mikhailovskaya's data by Meisner, 1932:52 and Dekhtyareva, 1940:47, but authorship given to Mikhailovskaya by Svetovidov, 1952, 1963); Caspialosa brashnikovi sarensis Mikhailovskaya, 1941:560 (western coast of southern and central Caspian); Caspialosa brashnikovi derzhavini Tarasevich, 1946:48 (biometrics); Alosa brashnikovi - Svetovidov, 1952:251 et seq., pls 15-20 (synopsis; subspecies brashnikovi, grimmi, nirchi, autumnalis, orientalis, sarensis, agrachanica, kisselevitshi; also maeotica, considered a species here; also Alosa curensis, considered a subspecies of A. brashnikovi here); Idem, 1963:280 et seq., pls 15-20 (same).

FAO Names : En - Caspian marine shad.



Diagnostic Features : Body fairly elongate, more 'herring-like' than 'shad-like'. Total gillrakers 18 to 47, thick and coarse, shorter, equal to or a little longer than gill filaments, either straight or curved, pointed or blunt, occasionally even bifurcated at tips. Teeth well developed in both jaws. Other Caspian shads have deeper, more shad-like bodies (*A. caspia*, which has more gillrakers, 50 to 180; *A. saposhnikovi* and *A. sphaerocephala*).

Geographical Distribution : Caspian Sea (throughout, but mainly in south).



Habitat and Biology : Brackishwater, non-anadromous, and not entering freshwaters, but strongly migratory. Feeds on small clupeids, gobies, atherines, also crustaceans and occasionally insects and molluscs. Various spawning patterns among the subspecies (mostly in spring and summer after an inshore migration and movement northward).

Size : To almost 50 cm standard length, usually around 30 cm (mature at about 20 cm).

Interest to Fisheries : Some of the subspecies are of considerable importance (especially *A. brashnikovi brashnikovi*, *A. brashnikovi agrachanica* and *A. brashnikovi kisselevitshi*). The total catch for all Caspian *Alosa* spp. (including *A. brashnikovi*) in 1983 was 3 561 tons. Coad (1980:70) claimed stocks depleted in Iranian freshwaters.

Local Names : USSR: Kaspiisko-Chernomorskie morskie sel'di, brazhnikovskie sel'di. Svetovidov (1952, 1963) gives further Russian names for the subspecies.

Literature : Mikhailovskaya (1941 - subspecies); Svetovidov (1952, 1963 - synopsis).

Remarks : Svetovidov (1952, 1963) recognized nine subspecies, mainly separated on the number and form of the gillrakers. Following Banarescu (1964:244), Svetovidov's *maeotica* of the Black Sea is recognized as a distinct species (thus *A. brashnikovi* becomes entirely Caspian), while his *A. curensis* is included here as a subspecies of *A. brashnikovi* (which he seems to have suspected). The following nine subspecies occur:

A. brashnikovi agrachanica: total gillrakers 20 to 46 (M 33); western Caspian, or southeast in winter

A. brashnikovi autumnalis: total gillrakers 21 to 37 (usually 26 to 33); southern Caspian

A. brashnikovi brashnikovi: total gillrakers 27 to 47 (M 34); throughout Caspian, spawning in north

A. brashnikovi curensis: total gillrakers 32 to 38 (M 34); western part of southern Caspian

A. brashnikovi grimmi: total gillrakers 18 to 27 (M 22); eastern coasts of southern Caspian

A. brashnikovi kisselevitshi: total gillrakers 30 to 49 (usually 34 to 42); southern Caspian, mainly southwest

A. brashnikovi nirchi: total gillrakers 20 to 30 (M 25); eastern part of Caspian

A. brashnikovi orientalis: total gillrakers 24 to 34 (M 28); eastern part of southern Caspian

A. brashnikovi sarensis: total gillrakers 23 to 32 (M 27); western part of southern Caspian.

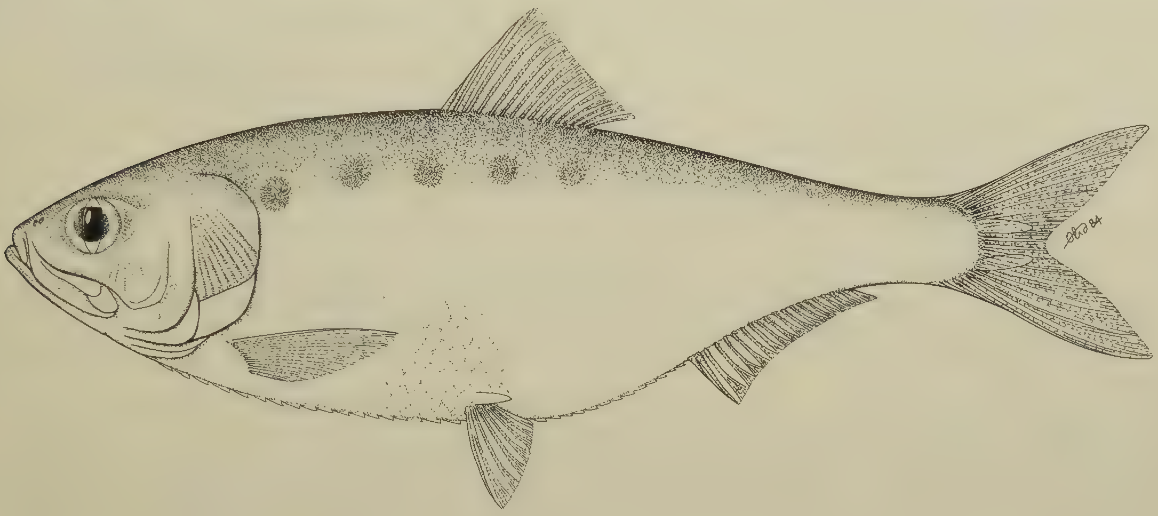
Alosa caspia (Eichwald, 1838)

CLUP Alos 7

Clupea caspia Eichwald, 1838, Bull.Soc.Nat.Moscou, **11**(2):134 (Caspian, toward the south).

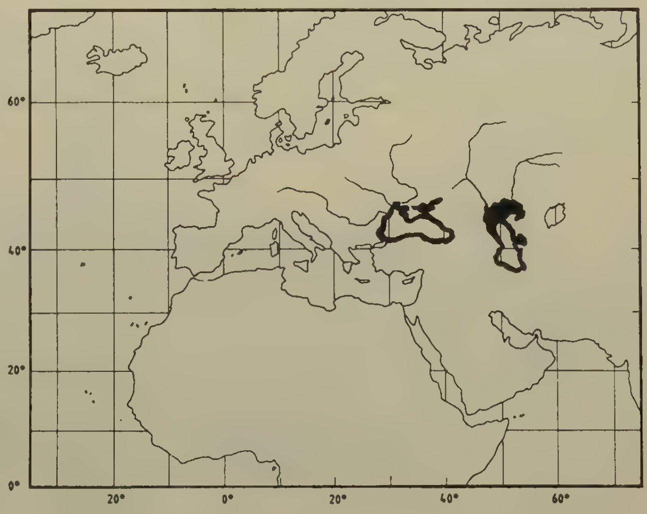
Synonyms : Clupea tanaica Grimm, 1901:59, 62, 67 (Sea of Azov); Alosa nordmanni Antipa, 1906:28, pl. 2, figs 6-10 (Black Sea, northwestern part); Clupea macedonica Vinciguerra, 1921:4 (Lake Volvi); Caspialosa knipowitscha Il'in, 1927:69, fig. (Enzeli Bay); Caspialosa caspia var. persica Il'in, 1927:72 (on data by Suvarov, 1907); Alosa bulgarica Drensky, 1934:79, figs 1, 2 (Black Sea, southward from Burgas); Caspialosa tanaica palaeostomi Sadowsky, 1934:139 (Paläeostome lagoon); Alosa alosa bulgarica:Svetovidov, 1952:313, pl. 25, fig. 1 (synopsis); Idem, 1963:352, pl. 25, fig. (same); Caspialosa caspia salina Svetovidov, 1963:51 (Caspian Sea, northeast part); Alosa alosa macedonica:Svetovidov, 1952:313 (mention); Idem, 1963:352 (mention); Alosa caspia - Svetovidov, 1952:229 et seq., pls 10-15, fig. 1 (synopsis; subspecies caspia, knipowitschi, salina, persica, tanaica, nordmanni, palaeostomi); Idem, 1963:254 et seq., pls 10-15, fig. 1 (same); Bănărescu, 1964:245, fig. 107 (Black Sea; as Alosa (Caspialosa) caspia nordmanni); CLOFNAM, 1973:106 (synonymies; includes subspecies bulgarica, nordmanni, palaeostomi, tanaica); FNAM, 1984:270, fig. (synopsis; subspecies as in CLOFNAM, diagnosed).

FAO Names : En - Caspian shad.



Diagnostic Features : Body 'shad-like', usually rather deep and compressed. Total gillrakers 50 to 180, long and thin, distinctly longer than gill filaments. Teeth poorly developed in jaws, sometimes barely detectable. A black spot posterior to gill opening and occasionally further black spots on flank in some cases. Resembles A. kessleri in gillraker numbers, but that species is more slender and 'herring-like'; other Caspian shads have fewer gillrakers (A. brashnikovi 18 to 47; A. sapashnikovi 25 to 41; A. sphaerocephala 26 to 42), while other Black Sea shads also have fewer gillrakers and are more slender and 'herring-like' (A. pontica 47 to 69, thus a slight overlap; A. maeotica 33 to 46).

Geographical Distribution : Caspian Sea, Black Sea, Sea of Azov.



Habitat and Biology : Euryhaline, migratory, chiefly in brackishwaters, but entering freshwaters to spawn; one of the most warm-loving Alosa of the Caspian. Feeds on plankton. Depending on the subspecies some are semi-anadromous and spawn in fresh or slightly saline waters, mainly in the lower reaches, whereas others are practically marine and spawn in brackish or even fully saline oceanic waters.

Size : To 28 cm standard length, usually 18 to 22 cm (Caspian) or to 20 cm standard length, usually only 14 to 16 cm (Black Sea, Sea of Azov).

Interest to Fisheries : Only Alosa caspia caspia of the Caspian Sea is of importance, the other subspecies contributing little. The total catch for Caspialosa spp. (including A. caspia) in 1983 was 3 561 tons.

Local Names : USSR: Kaspiisko puzanok (numerous other names for the subspecies - see Svetovidov, 1963:257 et seq.).

Literature : Svetovidov (1952, 1963 - synopsis); Bănărescu (1964, Black Sea).

Remarks : Svetovidov (1952, 1963) recognized 7 subspecies, mainly separated on body shape, gillraker numbers, pectoral fin length and distribution, adding a further subspecies subsequently (his previous A. alosa bulgarica - Svetovidov, 1973:106, i.e. CLOFNAM). Economidis (1973) has shown that Svetovidov's A. alosa macedonica (Vinciguerra, 1921, of Lake Volvi, Greece), is a true 'Caspialosa' (teeth on vomer and palatines) and thus not A. alosa; since its gillraker count is within the range for the widespread A. caspia and its body is deep and 'shad-like', it seems best regarded as a subspecies of A. caspia. Economidis & Sinis (in press) have described yet another lacustrine subspecies, from Lake Vistonis (Greece). This makes 10 subspecies altogether:

Caspian subspecies

A. caspia caspia: total gillrakers 70 to 150 (usually 100 to 140); Caspian (mainly western half, but to south and east in winter).

A. caspia knipowitschi: total gillrakers 120 to 180 (usually 130 to 160); Caspian Sea (southern part, mainly western half).

A. caspia persica: total gillrakers 50 to 110 (usually 60 to 90); Caspian Sea (southern part, mainly in east).

A. caspia salina: total gillrakers 60 to 120 (usually 80 to 100); Caspian Sea (eastern half).

Black Sea, Sea of Azov subspecies

A. caspia bulgarica: total gillrakers 100 to 107; Black Sea (southwestern part).

A. caspia macedonica: total gillrakers 106 to 128; Lake Volvi only (Macedonia).

A. caspia nordmanni: total gillrakers 66 to 88 (average about 80); Black Sea (western part).

A. caspia palaeostomi: total gillrakers 73 to 87 (average about 76); Black Sea (south eastern part).

A. caspia tanaica: total gillrakers 62 to 85 (average about 76); Sea of Azov and adjacent eastern parts of Black Sea.

A. caspia subsp. A of Economidis & Sinis: total gillrakers 78 to 97; Lake Vistonis only (Macedonia).

The scheme adopted here is compiled from the literature and merely represents a synopsis of all the forms of Alosa that have a deep, 'shad-like body, numerous gillrakers (50 or more) and teeth on the vomer and palatines. The true relationships, in spite of Svetovidov's painstaking studies, are yet to be discovered; a separation of Caspian from Black Sea forms might be expected, but no morphometric or meristic basis for this exists at present.

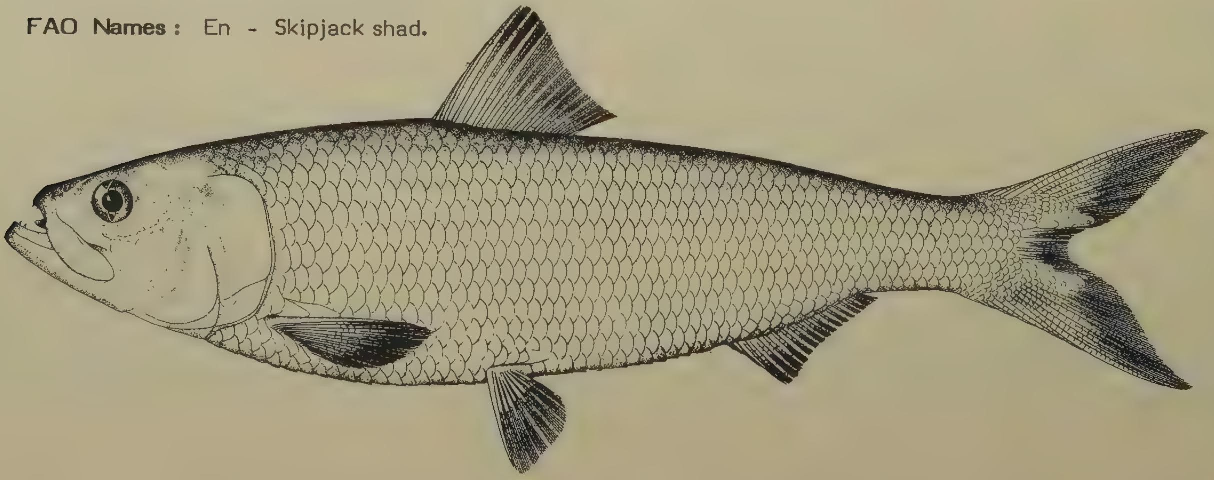
Alosa chrysochloris (Rafinesque, 1820)

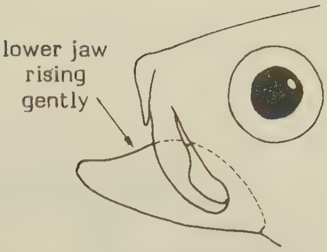
CLUP Alos 3

Pomolobus chrysochloris Rafinesque, 1820, West.Rev.Misc.Mag., 2:171 and Ichthyol.Ohiensis:39 (Ohio River, but seldom ascending to Pittsburgh; see Remarks for identity of Rafinesque's species).

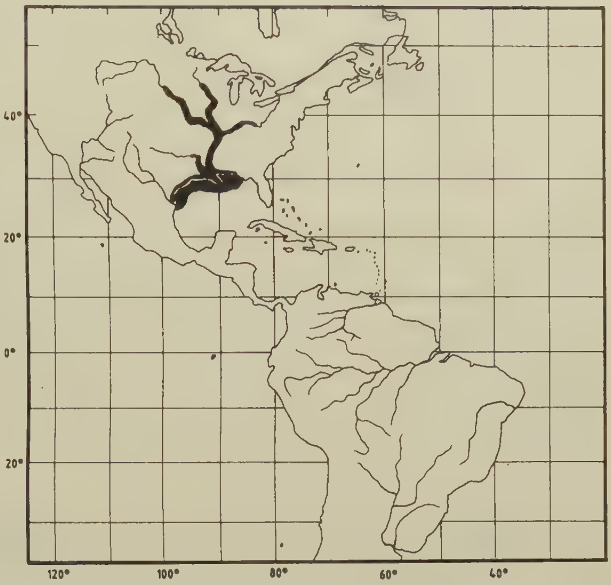
Synonyms : Pomolobus chrysochloris:FWNA, 1964:315, fig. 78 (full synon., descr., biol.).

FAO Names : En - Skipjack shad.





Diagnostic Features : Body fusiform, moderately compressed, belly with a distinct keel of scutes. Lower jaw not rising steeply within mouth; teeth present in jaws, prominent at front of lower jaw, but none on vomer. Lower gillrakers 20 to 24, slender. Back bluish green, abruptly changing to silver on flank; no dark spot at shoulder. The only other shad of the Gulf of Mexico, A. alabamae, has 41 to 48 gillrakers. Closely resembles A. mediocris of Atlantic coasts, which has no upper and weak lower jaw teeth, a dark shoulder spot and the body deeper than head length.



Geographical Distribution : Gulf of Mexico (from Corpus Christi in Texas eastward to Pensacola in Florida; also in rivers, e.g. Mississippi and Ohio Rivers to Minnesota, Wisconsin and Pennsylvania).

Habitat and Biology : Euryhaline, entering brackish- and freshwaters, but perhaps not always or not consistently anadromous, although strongly migratory within rivers, mostly in fast-flowing water where they are renowned for leaping (hence the common name). Feeds on small fishes, the juveniles on insects. Spawning times and places not certain (FWNA, 1964:317). Adults serve as hosts to the larvae (glochidia) of the economically valuable pearly mussel (Fusconaia ebena) of the Mississippi basin.

Size : To 50 cm standard length; usually 30 to 45 cm.

Interest to Fisheries : Little or none.

Local Names : USA: Blue or Green herring, Golden shad, River herring, Skipjack, Skipjack herring (AFS list).

Literature : Hildebrand (i.e. FWNA, 1964 - biol., etc.).

Remarks : Hildebrand (i.e. FWNA, 1964:315, footnote) noted that in the original description of Pomolobus chrysochloris, Rafinesque described the jaws as toothless, the flesh as 'esteemed' and the name as Ohio shad, all of which point to A. alabamae and not A. chrysochloris; however, to reverse the nomenclature would simply cause confusion.

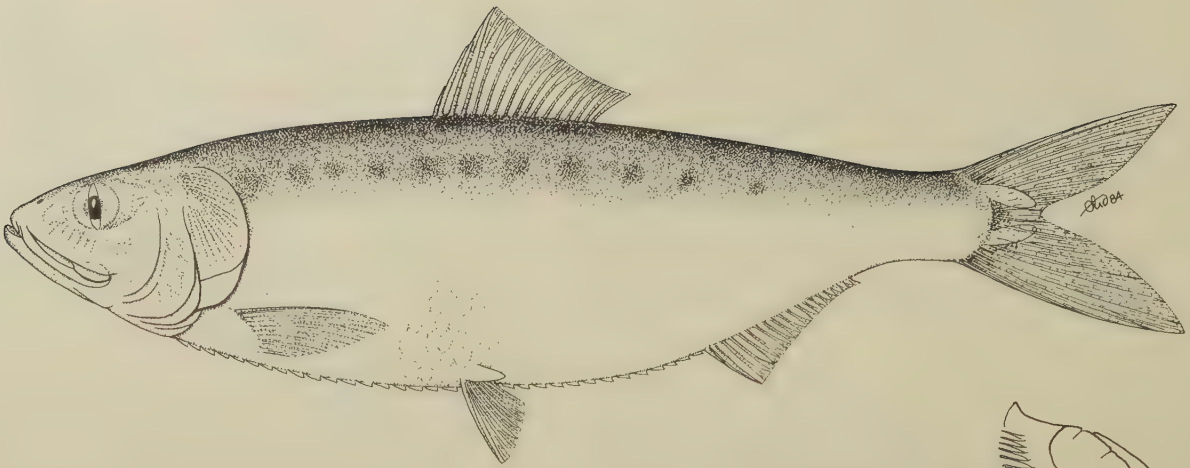
Alosa fallax (Lacepède, 1803)

CLUP Alos 6

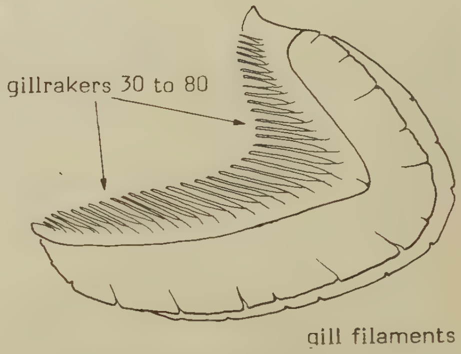
Clupea fallax Lacepède, 1803, Hist.nat.poiss., 5:452 (Seine).

Synonyms : Clupea rufa Lacepède, 1803:452 (Seine); Clupea nilotica E. Geoffroy Saint-Hilaire, 1808:pl. 10 (Nile); Clupea finta Cuvier, 1829:399 (Mediterranean); Alosa finta var. lacustris Fatio, 1890:51 (Lakes Como, Maggiore and Lugano); Alosa benacensis Barbieri, 1907 (Lake Garda); Alosa finta algeriensis, killarnensis and gracilis Regan, 1916:9, 10 (see Remarks); Alosa finta rhodanensis Roule, 1924:263 (Rhône); Alosa fallax bolivari Lozano y Rey, 1929:660, pl. 30, fig. 3 (costas del Rif); Alosa fallax - Svetovidov, 1952:310, figs 51, 52 (gillrakers), pl. 24, fig. 2 (synopsis); Idem, 1963:346, figs 51, 52, pl. 24, fig. 2 (same); Wheeler, 1969:128, fig. (synopsis); CLOFNAM, 1973:107 (synonymy); Wheeler, 1978:68, fig. (synopsis); Eiras, 1980:7 (Portugal, meristics); FNAM, 1984:271, fig. (synopsis); CLOFETA, in press (synonymy); Whitehead & Bauchot, in press (some types of A. vulgaris Valenciennes, 1847 = A. fallax, not A. alosa; types of Clupea rufa and A. f. rhodanensis).

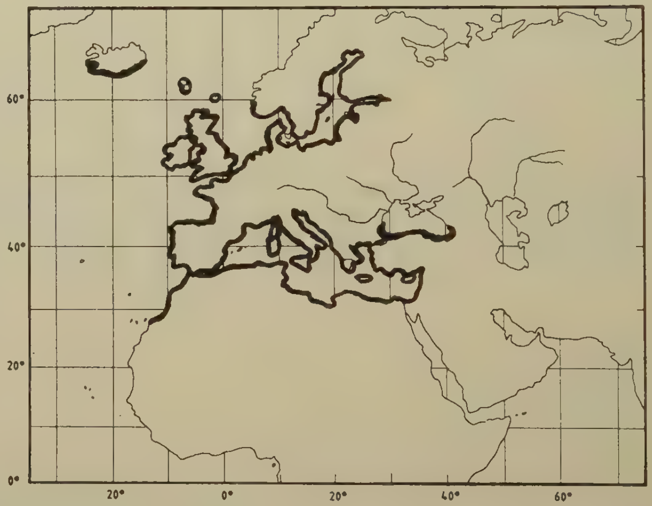
FAO Names : En - Twaite shad.



Diagnostic Features : Body somewhat compressed, moderately deep (but depth at pectoral fin less than head length), scutes apparent along belly. Upper jaw notched, lower jaw fitting into it; no teeth on vomer. Gillrakers fairly short and stout, total 30 to 80, shorter than gill filaments. A dark spot posterior to gill opening, followed by 7 or 8 similar spots along flank (but sometimes faint or absent). Resembles *A. alosa*, which has more and longer gillrakers (total 85 to 130) and at most only 3 dark spots on flank. See CLUP Alos 6, Fishing Areas 34, 47 (in part).



Geographical Distribution : Coasts of Europe, from southern coast of Iceland, British Islands, Baltic, south to Morocco; also whole of Mediterranean (but not Black Sea - Bănărescu, 1964).



Habitat and Biology : Marine, pelagic, schooling and strongly migratory, but apparently not penetrating far up rivers. Enters tidal parts of rivers in May or early June to spawn there or a little above; eggs demersal, scattered over gravel or sand, the fry moving down as they develop. Feeds on small fishes and crustaceans, the young taking the fry of herrings, sprats and gobies. More common and widespread than *A. alosa*, but similarly suffers from river pollution and to some extent from river barrages.

Size : To 55 cm standard length and 1.5 kg.

Interest to Fisheries : Palatable, but bony. Not always separated from *A. alosa* in fishery records, but probably makes up the major part of *Alosa* catches reported from France, Portugal and Morocco (267 tons in 1983).

Local Names : Very many names are given by Palombi & Santarelli (1961:9), including variants on Ceppa, Fint, Lacia, Losa, Savel, etc.

Literature : Svetovidov (1952, 1963 - synopsis); Wheeler (1969, 1978 - synopsis); FNAM (1984 - synopsis).

Remarks : Regan (1916:7) recognized six subspecies and subsequent authors (e.g. Svetovidov, 1952, 1963 and Wheeler, 1969) have accepted at least some of these, based mainly on gillraker counts:

Anadromous subspecies

A. fallax fallax: total gillrakers 37 to 42; Atlantic coasts.

A. fallax nilotica: total gillrakers 34 to 37; Mediterranean, Adriatic (common), perhaps Marmora and Black Seas (if so, then rare).

Landlocked lacustrine subspecies (high gillraker counts)

A. fallax benacensis: Lake Garda, Italy (30 to 40 or more lower gillrakers *fide* Regan, 1916 in his *A. fallax gracilis*, overlooking the earlier name *benacensis* of Barbieri, 1907).

A. fallax killarnensis: total gillrakers 43 to 53; landlocked in Killarney lakes, Ireland (to 23 cm standard length only; feeds on Cladocera).

A. fallax lacustris: total gillrakers to 76; Lakes Como, Maggiore and Lugano, Italy (30 to 34 lower gillrakers *fide* Regan, 1916).

Regan's subspecies *algeriensis* and Roule's *rhodanensis* have both been placed in *A. fallax nilotica* (e.g. CLOFNAM, 1973:107, 108).

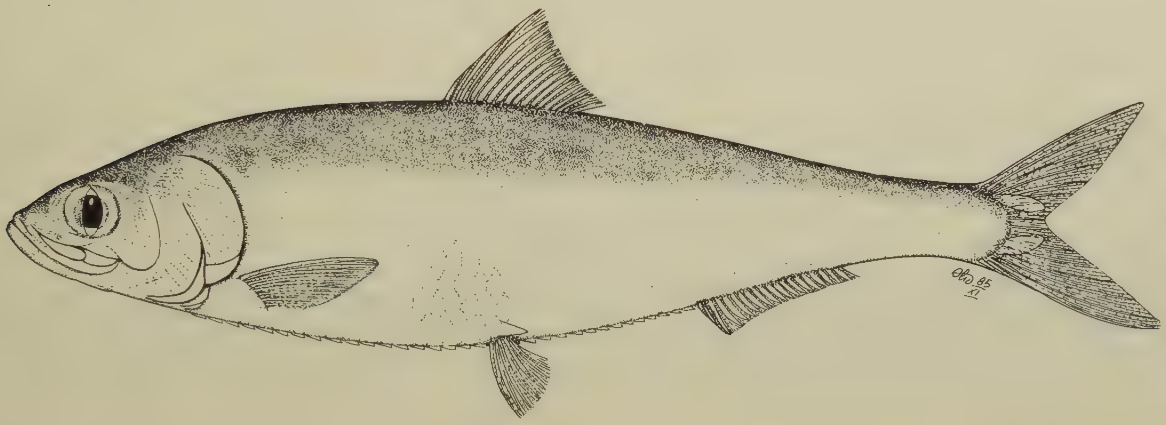
Alosa kessleri Grimm, 1887

CLUP Alos 15

Clupea kessleri Grimm, 1887, Astrakhanskaya seledka, St. Petersburg:7, 16 (Volga River delta).

Synonyms : *Clupeonella caspia volgensis* Berg, 1913:34, pl. 5 (near mouth of Sulak River, west coast of central Caspian); *Caspialosa volgensis bergi* and *imitans* Tanasiichuk, 1938:33; *Alosa kessleri*:Svetovidov, 1952:280, pl. 21, fig. 2 and pls 22, 23 (synopsis, subspecies *kessleri*, *volgensis* and *pontica*, the latter here considered distinct); *Idem*, 1963:314, pl. 21, fig. 2 and pls 22, 23 (same).

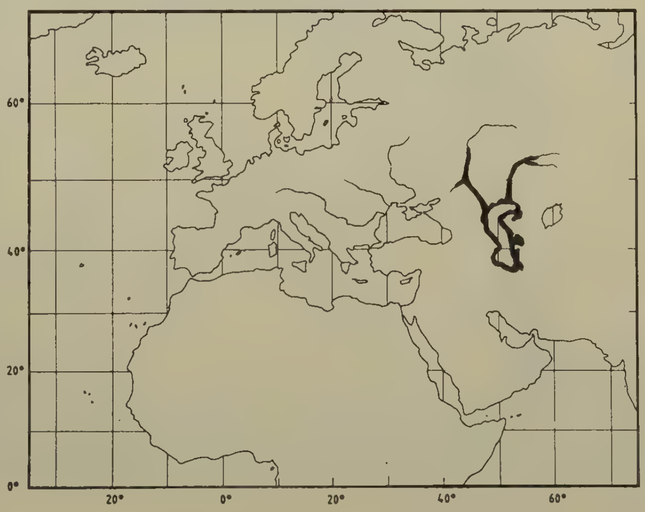
FAO Names : En - Caspian anadromous shad.



Diagnostic Features : Body fairly elongate, more 'herring-like' than 'shad-like'. Total gillrakers 59 to 155, thick, coarse and shorter than gill filaments in some, long, thin and equal to or longer than gill filaments in others (i.e. *A. kessleri volgensis*). Teeth well developed in both jaws. Resembles *A. caspia* in number of gillrakers, but that species is deep-bodied, more 'shad-like'; other Caspian shads have less than 50 gillrakers (*A. brashnikovi*, *A. saposhnikovi*, *A. sphaerocephala*).

Geographical Distribution : Caspian Sea (in sea and along both shores of central and northern parts, but in south and especially southeast in winter).

Habitat and Biology : Euryhaline, anadromous, from surface down to 85 m or more; northward migration in spring (March/April, but sometimes as early as February or even January), a little distance from the shore. Feeds chiefly on small fishes (*Clupeonella*, atherines, etc.), less frequently on crustaceans and insect larvae (but mainly on crustaceans in *A. kessleri volgensis*); no feeding by *A. kessleri kessleri* during migration up rivers. Spawns from mid-May to August in the Volga, Vyatka, Kama, Oka and other rivers, some entering with ripe gonads and spawning in the lower reaches or even delta (*A. kessleri volgensis*), others entering unripe and reaching as much as 500 km upstream; the young descend in late summer and autumn.



Size : To 52 cm standard length, usually 36 to 44 cm (or to 40 cm standard length, usually 27 to 29 cm in *A. kessleri volgensis*).

Interest to Fisheries : The Volga subspecies is the more abundant and occupies second place among the Caspian herrings. The total catch for all Caspian *Alosa* spp. (including *A. kessleri*) in 1983 was 3 561 tons. Coad (1980:70) claimed stocks depleted in Iranian freshwaters.

Local Names : USSR: Chernospinka (*A. kessleri kessleri*); Volzhskaya (Volga subspecies). Svetovidov (1952, 1963) gives further Russian names.

Literature : Svetovidov (1952, 1963 - synopsis).

Remarks : This is the only anadromous Caspian shad. The differences in gillraker form and in spawning and feeding habits, as well as size, well justify Svetovidov's recognition of two subspecies:

A. kessleri kessleri: total gillrakers 59 to 92, thick, coarse and short; enters rivers unripe, spawns high and does not feed *en route*; usually 36 to 44 cm standard length.

A. kessleri volgensis: total gillrakers 99 to 155, long, thin; enters rivers ripe, spawns in lower parts, feeding *en route*; usually 27 to 29 cm standard length.

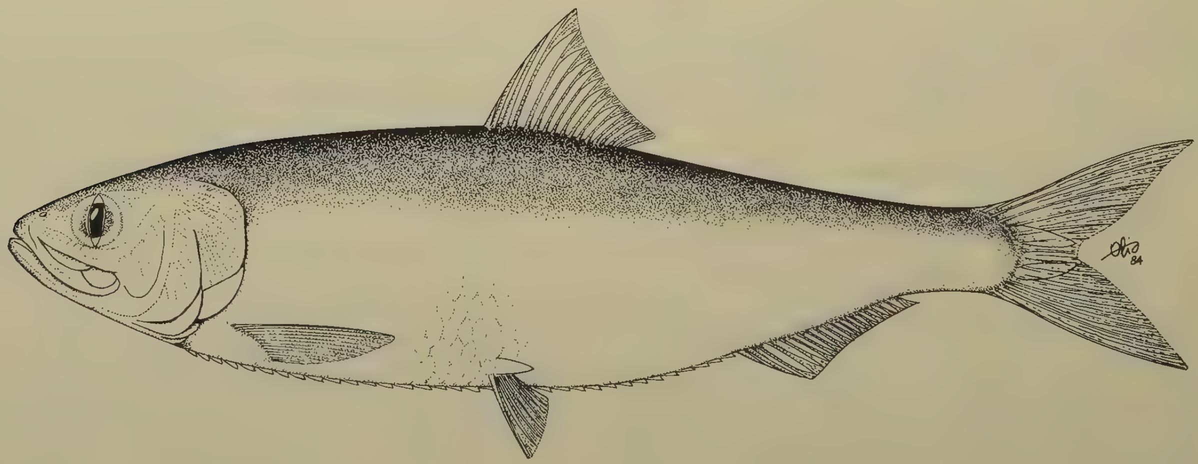
Alosa maeotica (Grimm, 1901)

CLUP Alos 9

Clupea maeotica Grimm, 1901, *Vestnik Rybopromyshlennosti*, **16**(2):67 (Black Sea, Sea of Azov).

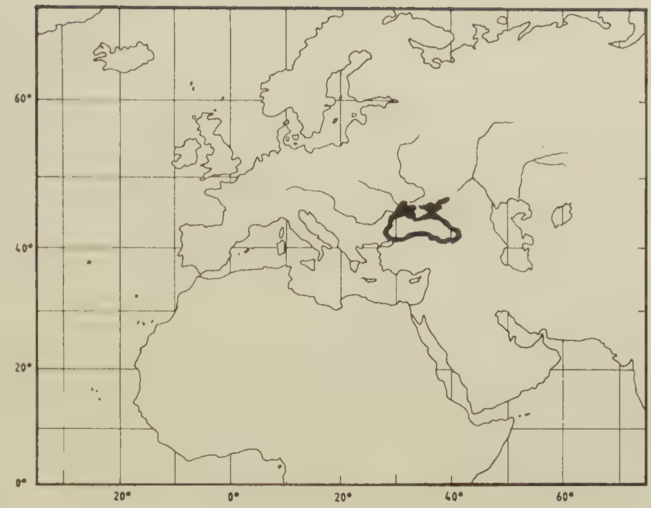
Synonyms : *Caspialosa brauneri* Nikolski, 1923:5 (Dneister liman at Akkeman and Ovidiopol, Black Sea); *Caspialosa brauneri* morph *elongata* Isachenko, 1925:128 (Ochakov, Black Sea); *Alosa brashnikovi maeotica*: Svetovidov, 1952:254, pl. 15, fig. 2 (synopsis); *Idem*, 1963:284, pl. 15, fig. 2 (same); *Alosa pontica pontica* var. ?:CLOFNAM, 1973:108 (see Remarks); *Alosa maeotica* - Bănărescu, 1964:244 (synopsis).

FAO Names : En - Black Sea shad.



Diagnostic Features : Body fairly elongate, more 'herring-like' than 'shad-like'. Total gillrakers 33 to 46, thin and straight, often closely packed and pointed, usually shorter than gill filaments. Teeth well developed in both jaws. Other Black Sea *Alosa* have more gillrakers (*A. caspia* 50 to 80 and *A. pontica* 47 to 66). *Sardinella aurita* is more slender, has many more gillrakers and i 8 pelvic finrays (i 7 in *A. maeotica*).

Geographical Distribution : Black Sea and Sea of Azov.



Habitat and Biology : Brackish- and saltwater, non-anadromous, entering limans and lower parts of river deltas, but only occasionally in freshwater; a cold-loving species, tolerating 3 or 4°C. Feeds mainly on small fishes (mainly sprats and anchovies) also on shrimps, gammarids and other large crustaceans. Spawns in spring and early summer.

Size : To 31 cm standard length, usually 16 to 20 cm.

Interest to Fisheries : Of little importance; combined catches with A. pontica in the Black Sea in 1983 were 1 839 tons (Romania and Bulgaria).

Local Names : ROMANIA: Scrumbie de mare; USSR: Chernomorsko-azovskaya morskaya sel'd.

Literature : Svetovidov (1952, 1963 - synopsis); Bănărescu (1964 - synopsis, Black Sea).

Remarks : Svetovidov (1973:108, i.e. CLOFNAM), having earlier recognized A. maeotica as a subspecies of A. brashnikovi, eventually placed it as a 'var.' (unnamed) of A. pontica, in spite of the apparent difference in gillrakers counts (33 to 46, cf. 47 to 69 in A. pontica).

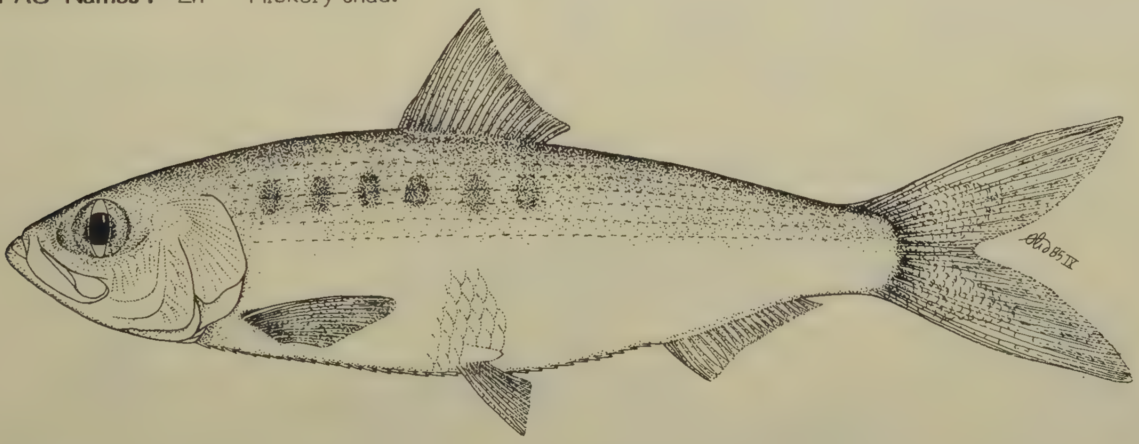
Alosa mediocris (Mitchill, 1814)

CLUP Alos 13

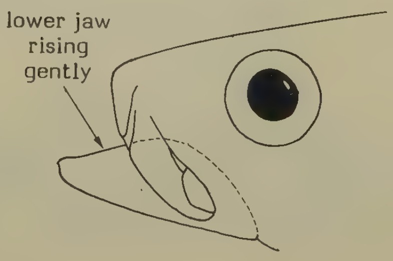
Clupea mediocris Mitchill, 1814, Fishes New York:20 (New York presumed).

Synonyms : ? Clupea pusilla Mitchill, 1814:20 (New York presumed); Clupea mattowaca Mitchill, 1815:451 (Long Island, New York); Pomolobus mediocris:FWNA, 1964:319, fig. 79 (full. synon., descr., biol.); Alosa mediocris - Mansueti, 1962:173, figs 3 (eggs), 4 (embryos), 5-9 (larvae and juveniles) (Maryland; breeding, eggs, larvae).

FAO Names : En - Hickory shad.



Diagnostic Features : Body fusiform, moderatley compressed, belly with a distinct keel of scutes. Lower jaw very prominent, but not rising steeply within mouth; teeth present in jaws, reduced or in upper jaw absent in larger fishes (over 23 cm standard length), none on vomer. Lower gillrakers 18 to 23. A dark spot on shoulder, several obscure dark spots along flank (missing sometimes). Closely resembles A. chrysochloris of the Gulf of Mexico, which has stronger jaw teeth, no shoulder spot and the body depth less than head length. Alosa aestivalis, A. pseudoharengus and A. sapidissima have more lower gillrakers (41 to 51, 38 to 44 and 59 to 73 respectively).



Geographical Distribution : North America (Atlantic coasts from Maine to the St John's River, Florida and in rivers).

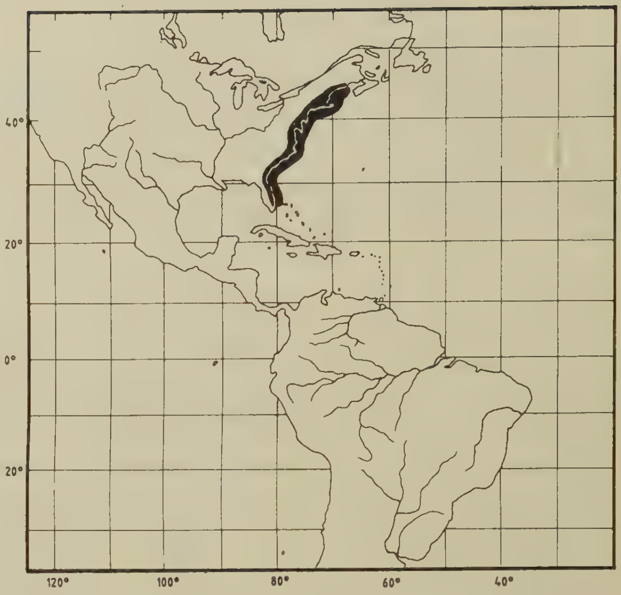
Habitat and Biology : Euryhaline, entering brackish- and freshwater, anadromous. Feeds on small fishes, also squid, small crabs and other crustaceans, as well as fish eggs. Spawns in tidal freshwater (Patuxent River, Chesapeake Bay in May fide Mansueti, 1962).

Size : To 60 cm standard length, usually 30 to 38 cm.

Interest to Fisheries : Of minor importance, the recorded catch for 1983 being only 34 tons. Caught with seine nets, pound nets, and in lesser quantities in gill and fyke nets.

Local Names : USA: Bonejack, Fall herring, Freshwater taylor, Hickory Jack, Shad herring.

Literature : Hildebrand (i.e. FWNA, 1964 - biol., etc.); Mansueti (1962 - spawning).



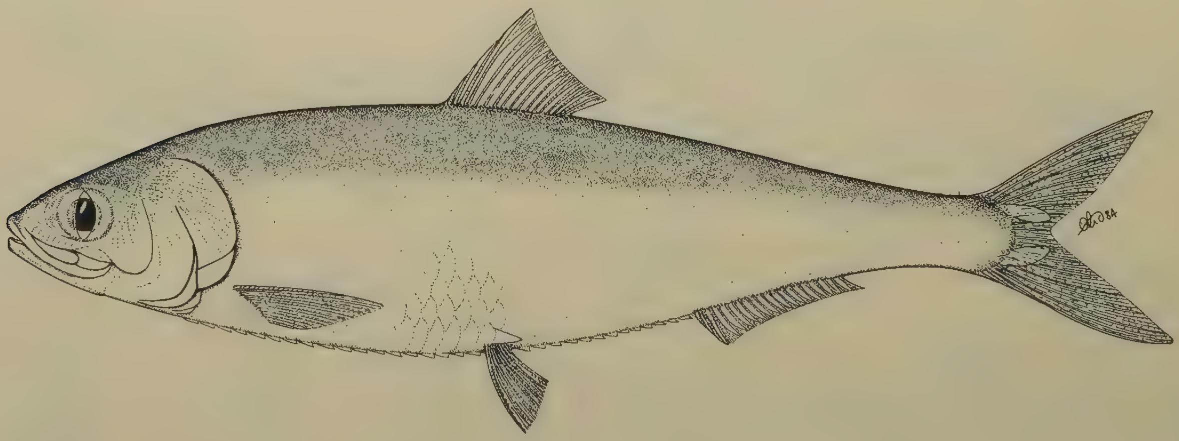
Alosa pontica (Eichwald, 1838)

CLUP Alos 10

Clupea pontica Eichwald, 1838, Bull.Soc.Nat.Moscou, **11**(2):135 (Odessa, Black Sea).

Synonyms : ? Alosa immaculata Bennett, 1835 (Trabizon, Black Sea); Clupea eichwaldi Grimm, 1901:67 (Rostov on Don River); Alosa pontica var. russac Antipa, 1906:**78**:22, pl. 2, figs 1-5 (Danube delta); Alosa pontica var. danubii Antipa, 1906:17, pl. 1, figs 4-8 (Romanian coast, Danube to and above Braila); Alosa pontica var. nigrescens Antipa, 1906:21, pl. 1, figs 1-3 (Danube delta); Alosa pontica var. moriac Antipa, 1909; Caspialosa pontica var. chtamalocephala Isachenko, 1925:110, pl. 2 (Dneiper delta at Ochakov); Caspialosa pontica var. hypselocephala Isachenko, 1925:112, pl. 3; Alosa kessleri pontica:Svetovidov, 1952:282, pl. 21, fig 1 (synopsis); Idem, 1963:316, pl. 21, fig. 1 (same); Alosa (Caspialosa) pontica:Banarescu, 1964:239, fig. 106 (synopsis); subspecies borysthenis and issattschenkovi designated for the north-central Black Sea, but not diagnosed; Alosa pontica - CLOFNAM, 1973:108 (full synonymy, but excluding A. pontica pontica var. ? - see Remarks; FNAM, 1984:272, fig. (synopsis, but included A. maeotica in error).

FAO Names : En - Pontic shad.



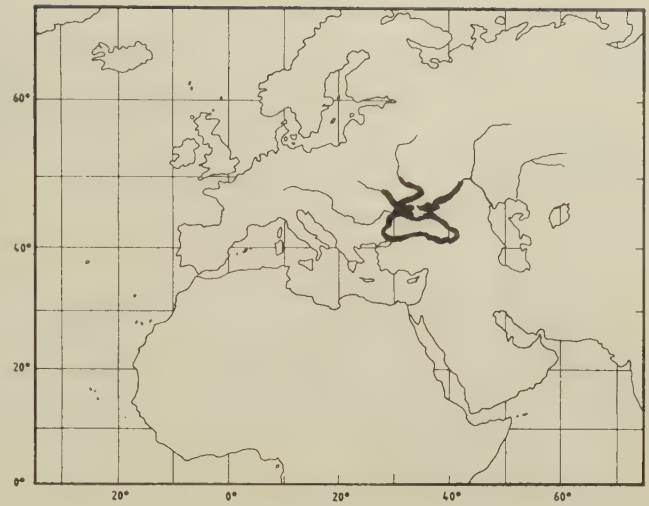
Diagnostic Features : Body fairly elongate, more 'herring-like' than 'shad-like'. Total gillrakers 47 to 69, rather thin, usually equal to or a little shorter than gill filaments. Teeth well developed in both jaws. Resembles A. caspia, which usually has more gillrakers (50 to 180, much longer than gill filaments), poorly developed teeth and a deeper, 'shad-like' body; A. maeotica has fewer gillrakers (33 to 36).

Geographical Distribution : Black Sea and Sea of Azov (in sea and in the Don, Danube and other rivers, as much as 567 km up the Don and as far as Kiev on the Dneiper before the dam was built).

Habitat and Biology : Euryhaline, anadromous, migratory, moving northward in the Black Sea in spring and early summer. Feeds mainly on small fishes (*Engraulis*, *Clupeonella*, *Sprattus*), but also crustaceans (*Crangon*, *Upogebia*, *Idothea*, gammarids). Spawns in rivers from mid-May to mid-August, as much as 500 km or more upstream, but also in lower reaches; the young descend quickly, but remain in or near the deltas or estuaries until winter.

Size : To 39 cm standard length (Dnieper), or 30 cm, usually 14 to 18 cm (Don); a small form of this species reaches only 21 cm.

Interest to Fisheries : The main component of the Black Sea *Alosa* catches, the combined total (with some *A. maeotica*) for 1983 being 1 839 tons (Romania and Bulgaria).



Local Names : GERMANY: Donauhering; ROMANIA: Scrumbie de Dunăre; USSR: Chernomorskaya sel'd (further Russian names in Svetovidov, 1952, 1963).

Literature : Svetovidov (1952, 1963 - synopsis; 1973:108, i.e. CLOFNAM - synonymy); Bănărescu (1964 - synopsis, Black Sea).

Remarks : Svetovidov (1952, 1963) recognized a large and a small form (morphologically identical otherwise), but rejected distinction of the 'varieties' *russac*, *nigrescens*, *danubii*, *chtamalocephala* and *hypselocephala*; Bănărescu (1964:239) added two more names, *borysthenis* and *issatschenkovi* from the northern-central part of the Black Sea, but did not diagnose them. In his earlier work Svetovidov placed the present species as merely a subspecies of *A. kessleri*, but finally he recognized it as distinct, although combining it with his earlier *A. brashnikovi maeotica* (see Remarks under that species). There would appear to be much more work needed to clarify the taxonomy of this difficult genus.

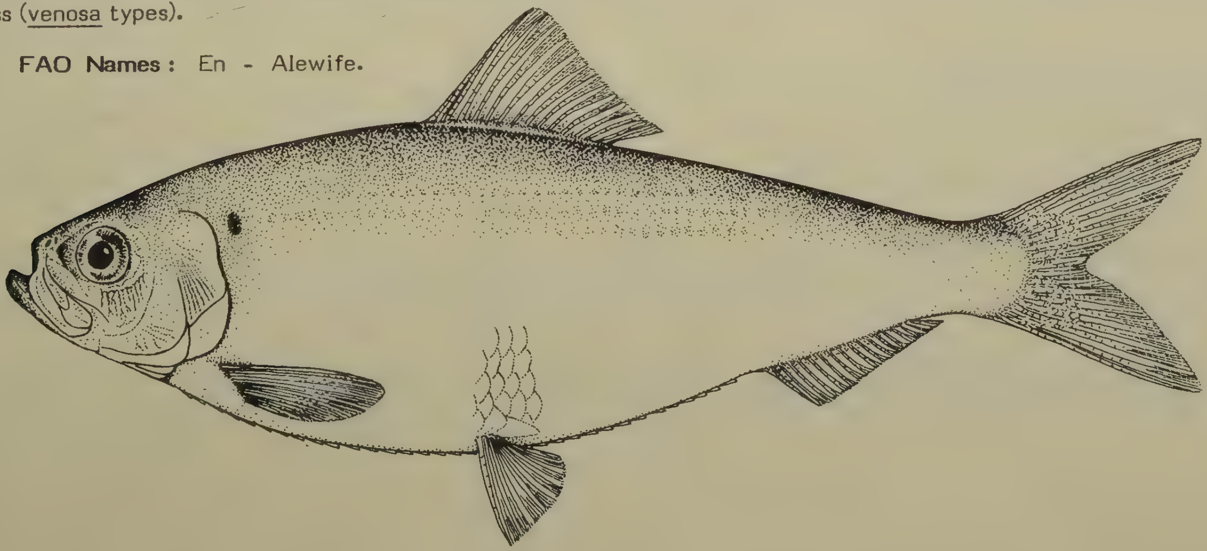
Alosa pseudoharengus (Wilson, 1811)

CLUP Alos 14

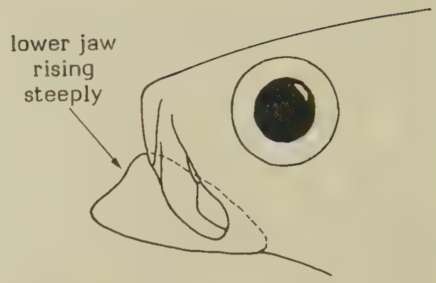
Clupea pseudoharengus Wilson, 1811, *Rees' New Cyclopedia (Art.Clupea)*, American ed. only, **9**:unpaged (probably Philadelphia).

Synonyms : *Clupea parvula* Mitchill, 1814:21 (New York presumed); *Clupea vernalis* Mitchill, 1815:454 (New York); *Clupea megalops* Rafinesque, 1818:206 (Delaware River); *Clupea virescens* DeKay, 1842:252, pl. 13, fig. 37 (New York Bay); *Meletta venosa* Valenciennes, 1847:374 (New York); *Pomolobus pseudoharengus*:FWNA, 1964:332, fig. 82 (full synon., descr., biol.); *Alosa pseudoharengus* - Whitehead, 1967:82 (types of *Meletta venosa*); Leim & Scott, 1966:88, fig. (Canada, synopsis); Roy, 1968:16, figs (Canada, synopsis); Whitehead & Bauchot, in press (*venosa* types).

FAO Names : En - Alewife.



Diagnostic Features: Body fusiform, moderately compressed, belly with a distinct keel of scutes. Lower jaw rising steeply within mouth; minute teeth present at front of jaws (disappearing with age), no teeth on vomer. Lower gillrakers 38 to 44, increasing with age. Back greyish green on capture; a dark spot on shoulder. Resembles A. aestivalis in number of gillrakers and steeply rising lower jaw, but that species has the eye not longer than snout, the peritoneum dark (cf. silvery) and the back blue on capture. Other shads have a gently rising lower jaw and more (59 to 73) or fewer (18 to 24) lower gillrakers, or occur only in the Gulf of Mexico (A. alabamae).

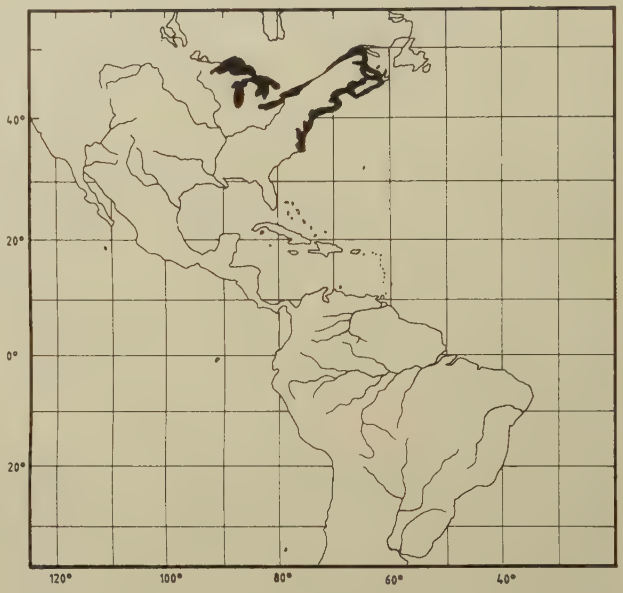


Geographical Distribution: North America (Atlantic coasts from the Gulf of St. Lawrence and Nova Scotia to North Carolina and in streams and rivers; introduced into Lake Ontario, and now landlocked there and in Lakes Erie (1931), Huron (1933), Michigan (1949) and Superior (1954); also occurs in Lakes Seneca and Cayuga).

Habitat and Biology: Euryhaline, entering brackish- and freshwaters, anadromous. Feeds on shrimps and small fishes, the young on diatoms, copepods and ostracods while in the rivers (see especially Janssen, 1976, 1978). Spawns in March in Chesapeake Bay area, late April or May in Maine and in Canada, the adults migrating up rivers and even small streams, spawning in lakes and quiet stretches of rivers; landlocked populations also ascend affluent rivers and streams; the fry descend in summer and autumn or even as late as November or December.

Size: To about 38 cm standard length, usually about 25 to 30 cm.

Interest to Fisheries: Probably not always distinguished from A. aestivalis; the recorded catch of A. pseudoharengus in 1983 was 18 385 tons, being the highest for a North American shad.



Local Names: CANADA: Gaspereau, Gasperot; USA: Bigeye herring, Branch herring, Freshwater herring, Gray herring, Grayback, Kyak, Sawbelly, White herring.

Literature: Hildebrand (i.e. FWNA, 1964 - USA, biol., etc.); Leim & Scott (1966 - Canada, biol., etc.); Roy (1968 - Canada, biol., etc.).

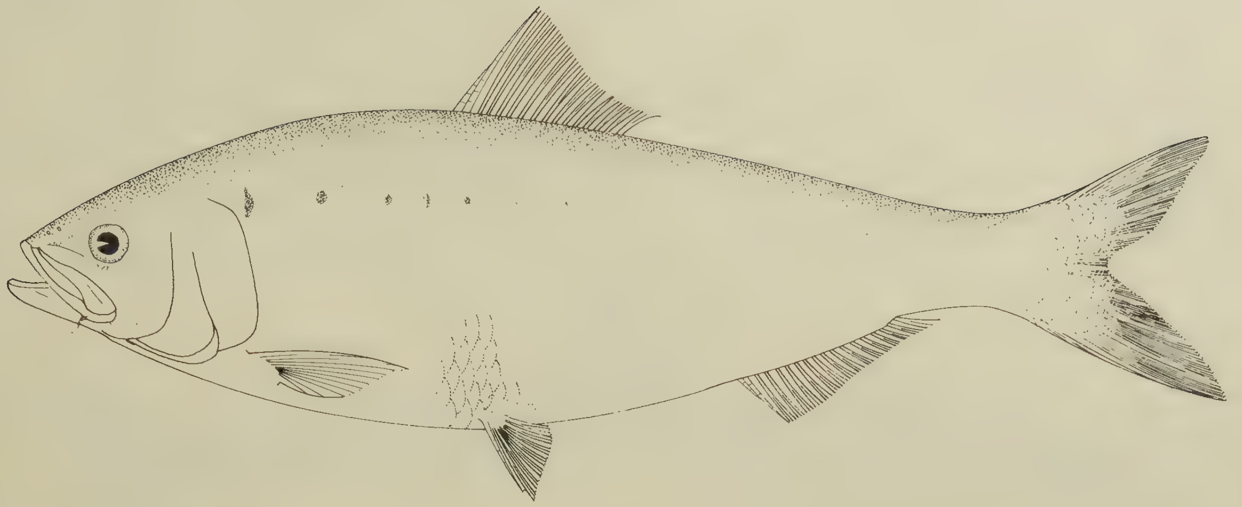
Alosa sapidissima (Wilson, 1811)

CLUP Alos 4

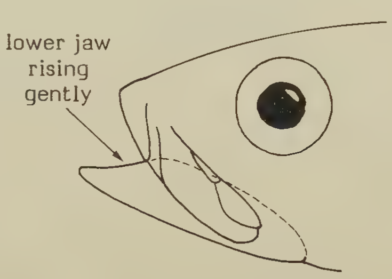
Clupea sapidissima Wilson, 1811, Rees' New Cyclopedia (Art.Clupea), American ed. only, **9**:unpaged (probably Philadelphia).

Synonyms: ? Clupea indigena Mitchill, 1814:22 (New York presumed); Alosa praestabilis DeKay, 1842:255, pl. 15, fig. 41 (New York); Mansueti, 1955:1, figs (Maryland, summary of biol.); FWNA, 1964:295, fig. 71 and figs 72-74 (devel.) (full synon., descr., biol.); Liem & Scott, 1966 (Canada, synopsis); Roy, 1968:3, figs (Canada, synopsis).

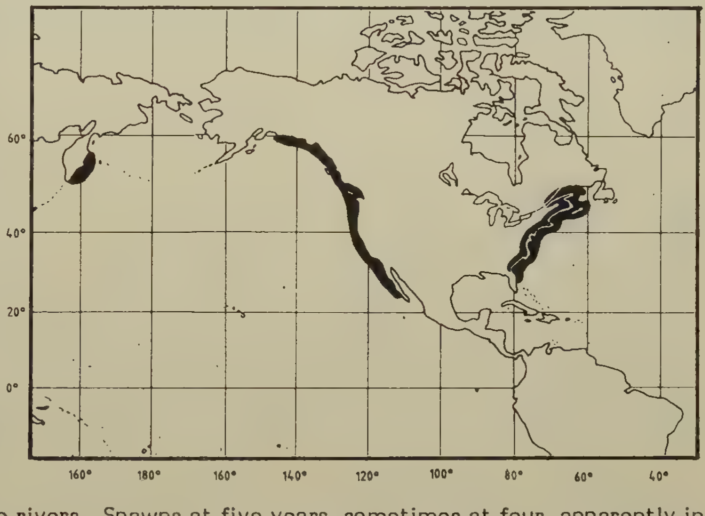
FAO Names: En - American shad.



Diagnostic Features : Body fusiform, moderately compressed, belly with a distinct keel. Lower jaw not rising steeply within mouth; teeth absent in jaws (minute in juveniles to 15 cm standard length), no teeth on vomer. Lower gillrakers 59 to 73, long and slender (fewer in young). A dark spot on shoulder, sometimes followed by several more, or even a second row. Resembles *A. pseudoharengus*, which has the lower jaw rising steeply within mouth and fewer lower gillrakers (38 to 43), as also *A. aestivalis* and *A. mediocris* (41 to 51 and 18 to 23 respectively). In addition, *A. pseudoharengus* has a larger eye (about equal to snout), but shorter jaws (not reaching behind hind margin of eye). See CLUP Alos 4, Fishing Area 31.



Geographical Distribution : North America (Atlantic coasts from the St. Lawrence River and Nova Scotia southward to central Florida and in streams and rivers). Introductions in the Gulf of Mexico apparently failed, but those off Pacific coasts of North America and USSR succeeded, the species now being found from Kamchatka and British Columbia to Baja California.



Habitat and Biology : Euryhaline, entering brackish- and freshwaters, anadromous; in the sea, down to about 100 m, strongly migratory (individuals have been caught up to 3 000 km from where they were tagged), in rivers migrating up as far as Montreal, but usually not ascending as far upstream as *A. pseudoharengus*. Feeds mainly on plankton, mainly copepods and mysids, occasionally on small fishes (smelt, sandlance); no feeding during migration up rivers; the young feed on copepods and insect larvae in the rivers. Spawns at five years, sometimes at four, apparently in their home river, on sandy or pebbly ground in the evening; enters rivers as early as November in Florida and as late as May or June in the north, depending on water temperature (peak runs at about 18.5^{0}C), descending again shortly after spawning; the young descend in the autumn.

Size : To 60 cm standard length, common to 50 cm.

Interest to Fisheries : Nowadays of moderate importance, chiefly in rivers of the USA; the total catch for 1983 was 2 712 tons (Canada and USA; Pacific coast catches very small).

Local Names : USA: Atlantic shad, Common shad, White shad.

Literature : Mansueti (1955 - Maryland, biol., etc.); Hildebrand (i.e. FWNA, 1964 - USA, biol., etc.); Liem & Scott (1966 - Canada, biol., etc.); Clemens & Wilby (1967 - Canada, Pacific, synopsis); Roy (1968 - Canada, biol., etc.); Leggett & Whitney (1972 - temperature and migrations, Atlantic and Pacific coasts); Dodson & Leggett (1974 - homing).

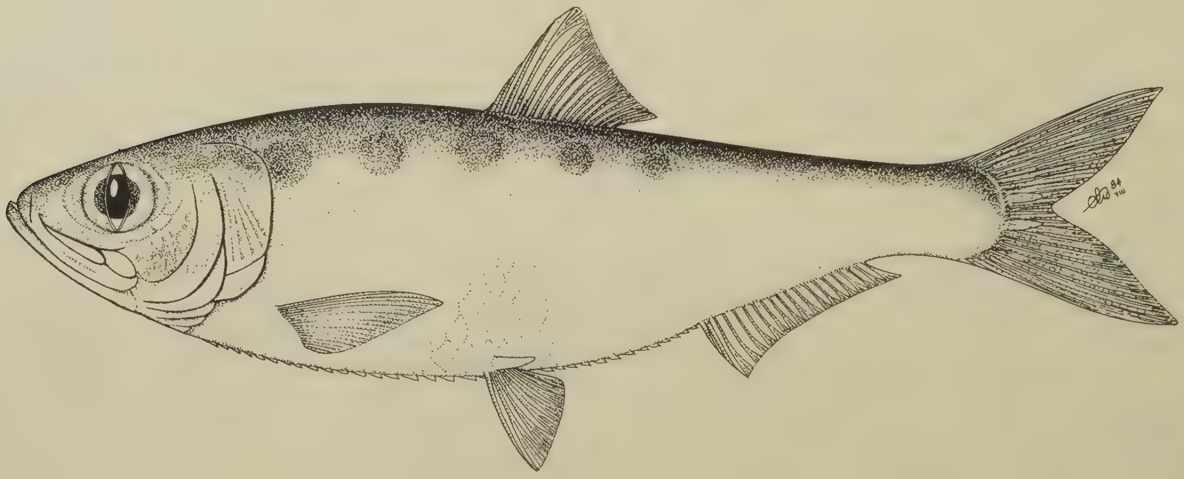
Alosa saposhnikovi (Grimm, 1887)

CLUP Alos 11

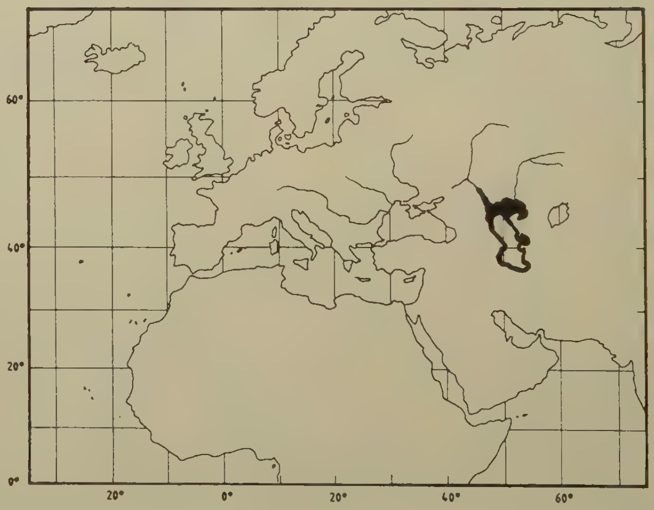
Clupea saposhnikovi Grimm, 1887, Astrakanskaya seledkha, St. Petersburg:7, 16 (Volga delta).

Synonyms : Alosa saposhnikovi - Svetovidov, 1952:223, pl. 9, fig. 1 (synopsis); Idem, 1963:247, pl. 9, fig. 1 (same).

FAO Names : En - Saposhnikovi shad.



Diagnostic Features : Body 'shad-like', rather deep and compressed; upper and lower head profiles straight. Total gillrakers 25 to 41, moderately thick and short, tips pointed, usually shorter than gill filaments. Teeth well developed in both jaws. Resembles A. sphaerocephala, which has a blunter head, with round upper and lower head profiles; A. caspia has more gillrakers (50 to 180) and A. brashnikovi is more slender and 'herring-like'.



Geographical Distribution : Caspian Sea (throughout, including lower parts of Volga River; more common in north).

Habitat and Biology : Euryhaline, migratory but non-anadromous; one of the most cold-loving Alosa of the Caspian, being one of the first to begin its spring migration to the north. Feeds on large crustaceans and small fishes. Spawns in northern Caspian, from end of April, with a peak in mid-May, moving into shallow water and spawning at depths of 1 to 6 m and salinities of 0.07 to 11^{o}/oo, the young later migrating southward (apparently down both coasts), but some perhaps remaining in the northern parts of the Caspian.

Size : To 35 cm standard length, usually 14 to 28 cm.

Interest to Fisheries : Moderately large catches reported by Svetovidov (1963:252); the total catch for Caspialosa spp. (including A. saposhnikovi) in 1983 was 3 561 tons. Coad (1980:70) claimed stocks depleted in Iranian freshwaters.

Local Names : USSR: Bol'sheglazyi ili saposhnikovskii puzanok.

Literature : Svetovidov (1952, 1963 - synopsis).

Remarks : Specimens of A. saposhnikovi (No. 15938, ZI Leningrad) apparently contributed to the description of Caspialosa caspia nigra Kisselevitch = Alosa brashnikovi (fide Svetovidov, 1963:242).

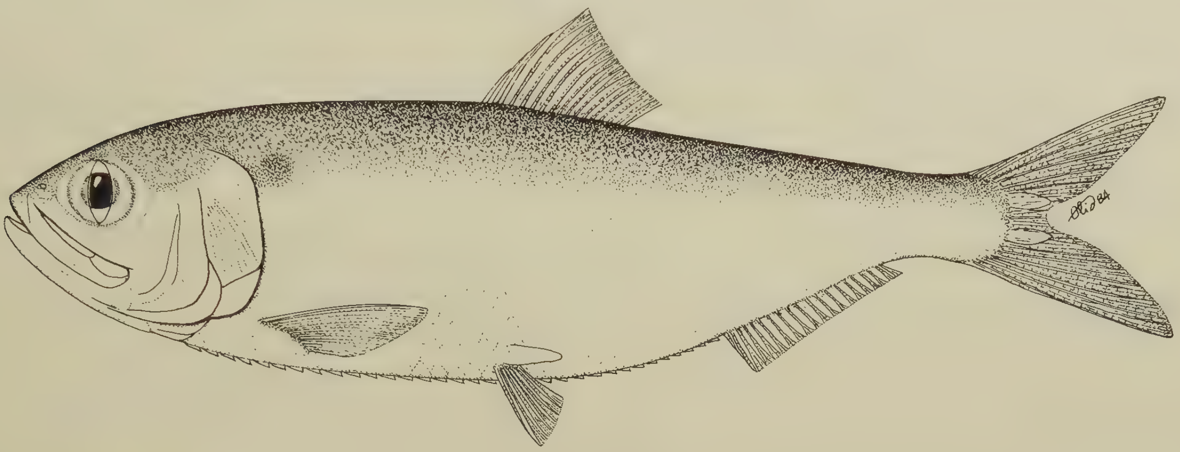
Alosa sphaerocephala (Berg, 1913)

CLUP Alos 12

Clupeonella sphaerocephala Berg, 1913, Mater.pozn.russ.rybol., 2(3):20, pl. 12, figs 1, 1a (Agrakhan Bay, at Tyulenii Island, Turali, Caspian Sea).

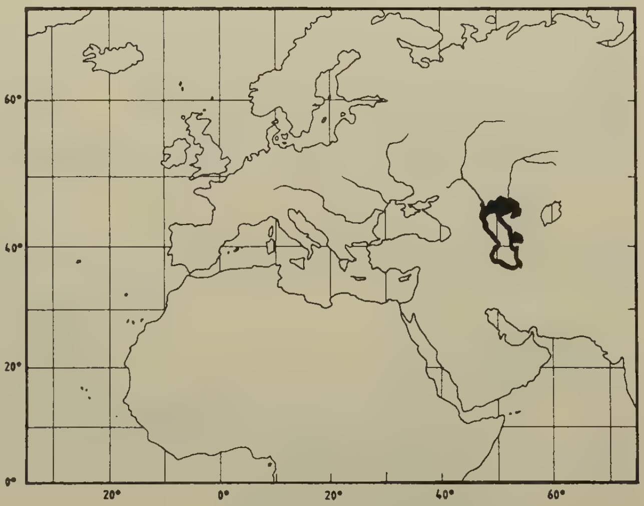
Synonyms : Alosa sphaerocephala - Svetovidov, 1952:227, pl. 9, fig. 2 (synopsis); Idem, 1963:252, pl. 9, fig. 2 (same).

FAO Names : En - Agrakhan shad.



Diagnostic Features : Body shape 'shad-like', rather deep and compressed; upper and lower head profiles strongly rounded. Total gillrakers 26 to 42, rather long and thin, equal to or usually longer than gill filaments. Teeth well developed in both jaws. Resembles A. saposhnikovi, which has a more pointed head, the upper and lower profiles straight; A. caspia has more gillrakers (50 to 180) and A. brashnikovi is more slender and 'herring-like'.

Geographical Distribution : Caspian Sea (more common in the northern and central parts).



Habitat and Biology : Confined to semi-saline waters; non-anadromous, not entering freshwaters. Food not recorded by Svetovidov (1963:254). Spawns in eastern part at north end of Caspian, from mid-May to end of June, mostly when temperatures are 18 to 20°C, salinities 8 to 10°/oo and at depths of around 3 m; young depart southward later than any other clupeids, late in autumn.

Size : To 25 cm standard length, usually 16 to 18 cm.

Interest to Fisheries : Caught in small quantities only.

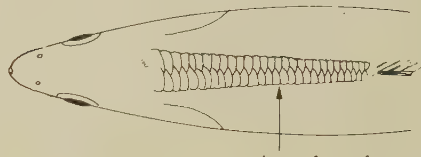
Local Names : USSR: Kruglogolovyi ili Agrakhanskii puzanok.

Literature : Svetovidov (1952, 1963 - synopsis).

Brevoortia Gill, 1861

CLUP Brevo

Brevoortia Gill, 1861, *Proc.Acad.nat.Sci.Philad.*:37 (type: *Brevoortia menhaden* Gill = *Clupea tyrannus* Latrobe).



Diagnostic Features : Moderately large herring-like fishes (to 50 cm standard length, usually 25 to 35 cm). Farly deep-bodied and compressed, the belly fully keeled with scutes. Head large, especially the gill cover; mouth large, the upper jaw distinctly notched in the midline, the tip of the lower jaw fitting into this notch; no teeth in jaws in adults. Gillrakers long, fin and very numerous, increasing with size of fish, those on upper part of arch overlapping those on lower part at angle of arch. Dorsal and anal fins short, the latter beginning under or behind base of last dorsal finray; pelvic finrays i 6. Distinguished from all other shads by the modified pre-dorsal scales on either side of midline, forming a ridge; other body scales deeply overlapping and rather irregular, with the hind margin serrated or pectinate. The pre-dorsal scales and the notched upper jaw distinguish *Brevoortia* from all other clupeids.

Biology, Habitat and Distribution : Marine pelagic and forming large or extremely large schools, mainly in shallow coastal waters, but also down to 60 m or more. Feed by filtering small elements of plankton. Spawn in sea, eggs floating. Western Atlantic, from Nova Scotia southward to northern Argentina.

Interest to Fisheries : After *Sardinops* and *Engraulis*, often the third most exploited clupeoid genus. The total catch of *Brevoortia* in 1983 was 1 345 519 tons (Fishing Areas 21, 31 and 41).

Species : Hildebrand (i.e. FWNA, 1964:345-346) recognized 7 species, but *B. brevicaudata*, known from only 8 specimens collected in 1874 and never recorded again, is here regarded as possibly a variant of *B. tyrannus*:

B. aurea (Spix & Agassiz, 1829) western Atlantic (Brazil, Argentina)
B. gunteri Hildebrand, 1948, western Atlantic (Gulf of Mexico)
B. patronus Goode, 1879, western Atlantic (Gulf of Mexico)
B. pectinata (Jenyns, 1842), western Atlantic (Brazil, Argentina)
B. smithi Hildebrand, 1941, western Atlantic (North Carolina to Florida, also eastern Gulf of Mexico)
B. tyrannus (Latrobe, 1802), western Atlantic (Nova Scotia to Florida).

Remarks : Geographically, the 6 species fall into three pairs (Atlantic, Gulf of Mexico, Brazil/Argentina); systematically, *B. gunteri* of the Gulf pairs with *B. smithi* of the Atlantic coasts (high gillraker forms, no spots on flank), while *B. patronus* of the Gulf pairs with the Atlantic *B. tyrannus* (low gillraker forms, spots along flanks).

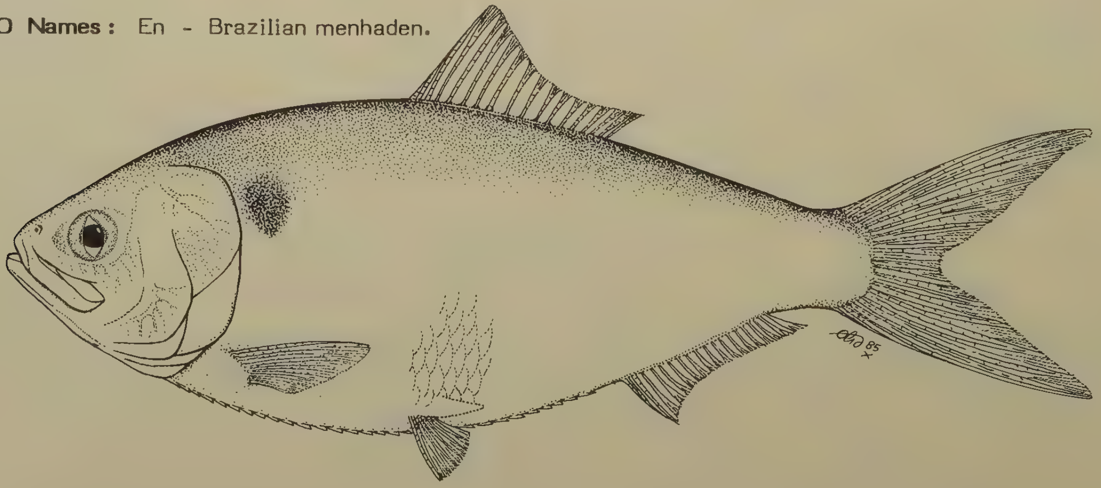
Brevoortia aurea (Spix & Agassiz, 1829)

CLUP Brevo 4

Clupanodon aureus Spix & Agassiz, 1829, *Select.gen.spec.piscium Bras.*, 1:52, pl. 21 (Brazil) (authorship incorrectly given only to Spix by Whitehead & Myers, 1971:485 - see Kottelet, 1985).

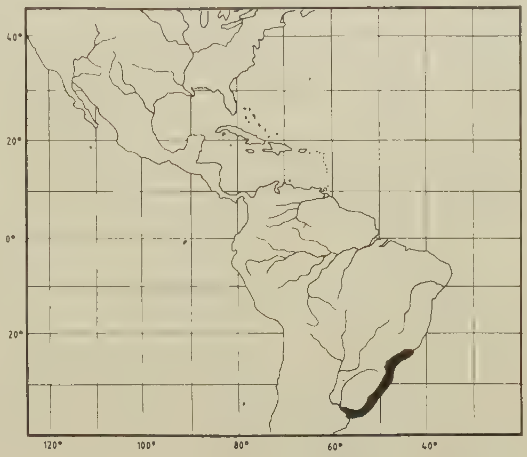
Synonyms : *Brevoortia aurea* - Hildebrand, 1948:25, fig. 5 (Brazil); FWNA, 1964:346 (in key only); Figueiredo & Menezes, 1978:24 (São Paulo, Rio de Janeiro, Brazil); Menni, Ringuelet & Arámburu, 1984:107 (Argentina, on refs).

FAO Names : En - Brazilian menhaden.



Diagnostic Features : Body deep and compressed, scutes apparent along belly. Upper jaw with distinct median notch, no teeth. Pectoral fin tip short of pelvic fin base by width of 3 to 7 scales; pelvic fin with oblique and almost straight hind margin. Pre-dorsal scales modified; scales in lateral series 48 to 56, those on back and above base of anal fin not markedly smaller than rest. A black spot behind gill opening, but none along flank. Closely resembles B. pectinata, which has only 35 to 46 scales in lateral series and pectoral fin tips short of pelvic fin base by width of only 0 to 3 scales. Other Brevoortia species occur only to north of Brazil. Other clupeids lack the modified pre-dorsal scales.

Geographical Distribution : Brazil (Rio de Janeiro, São Paulo, Santa Catarina and Rio Grande do Sul), Argentina (probably to mouth of Rio de la Plata, but needs confirmation; based on Berg, 1895:20, followed by Devincenzi & Burattini, 1928:pl. 17, fig. 3 (Uruguay) and Pozzi & Bordale, 1935:155 (Argentina, name only).



Habitat and Biology : Marine, pelagic, schooling. No data on food or breeding.

Size : To about 20 cm standard length (largest fish 26 cm in Museu de Zoologia, São Paulo).

Interest to Fisheries : Apparently not forming the enormous schools of B. tyrannus and B. patronus; catches in 1983 were 1 560 tons (Brazil).

Local Names : BRAZIL: Savelha; ARGENTINA: Lacha.

Literature : See under synonyms.

Remarks : More work is needed on this species, especially its separation from B. pectinata and relationship to the northern species.

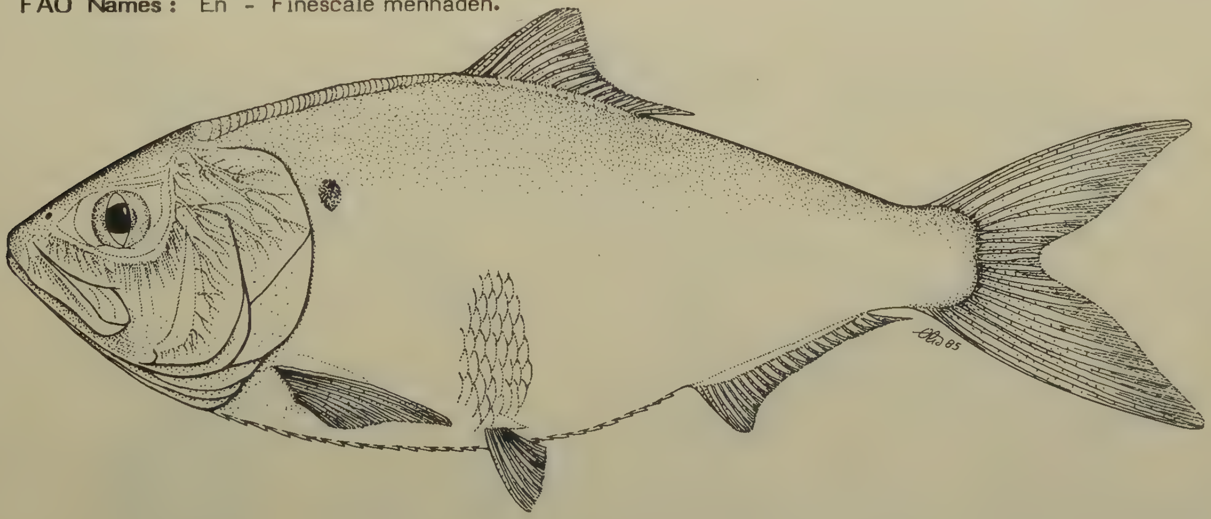
Brevoortia gunteri Hildebrand, 1948

CLUP Brevo 5

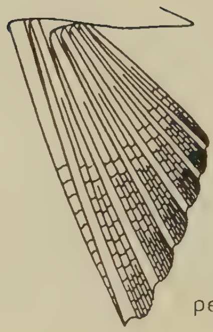
Brevoortia gunteri Hildebrand, 1948, Smithson.misc.Collns, **107**(18):31, figs 7, 8 (scales), 9 (pelvic fin) (Louisiana, Texas, Gulf of Mexico).

Synonyms : Brevoortia gunteri - Suttkus, 1958:402 (Gulf of Mexico, distr.); Christmas & Gunter, 1960:339 (Gulf of Mexico, Gulf of Campeche); FWNA, 1964:376, fig. 93 (key, descr., biol., etc.); Dahlberg, 1970:107 (key, descr., refs); Anon., 1976:68 (Mexico, south to Gulf of Campeche, key).

FAO Names : En - Finescale menhaden.



Diagnostic Features : Body deep and compressed, scutes apparent along belly. Upper jaw with distinct median notch, no teeth. Pelvic fin with oblique and almost straight hind margin, the inner finrays markedly shorter than the outer finrays when fin folded back. Pre-dorsal scales modified; scales in lateral series 60 to 77, small and numerous, those on back and above base of anal fin markedly smaller than rest. A black spot behind gill opening, but none along flank. Well distinguished from B. patronus of the Gulf of Mexico, which has fewer scales (42 to 48) and a rounded hind border to the pelvic fin (inner fin rays equal or nearly equal to outer when fin folded back). Very closely resembles B. smithi (Atlantic, also western coast of Florida), which has 30 to 32 scutes (cf. 27 to 29, infrequently 30 in B. gunteri) and the pectoral fin tip short of pelvic fin base by width of 3 to 5 scales (cf. only 1 or 2). Other clupeids lack the modified pre-dorsal scales.



Geographical Distribution : Gulf of Mexico (Chandeleur Sound, Louisiana, to the Gulf of Campeche, Mexico), but no certain records from Caribbean.

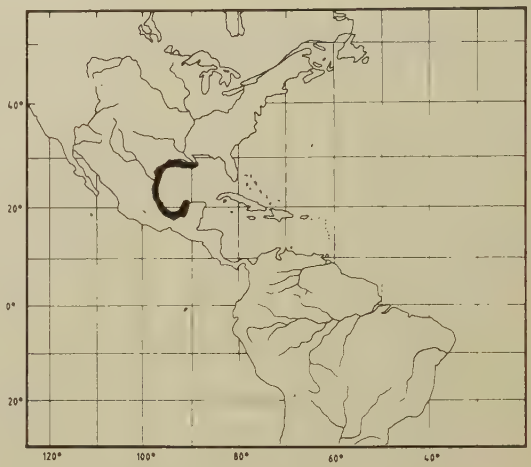
Habitat and Biology : Marine, pelagic, schooling in inshore waters, including bays (possibly euryhaline). Feeds on plankton. No data on breeding.

Size : To 26.4 cm standard length.

Interest to Fisheries : Of local importance, but not separated from B. patronus.

Local Names : -

Literature : Hildebrand (i.e. FWNA, 1964 - synopsis); Dahlberg (1970 - taxonomic and biol. data, refs).



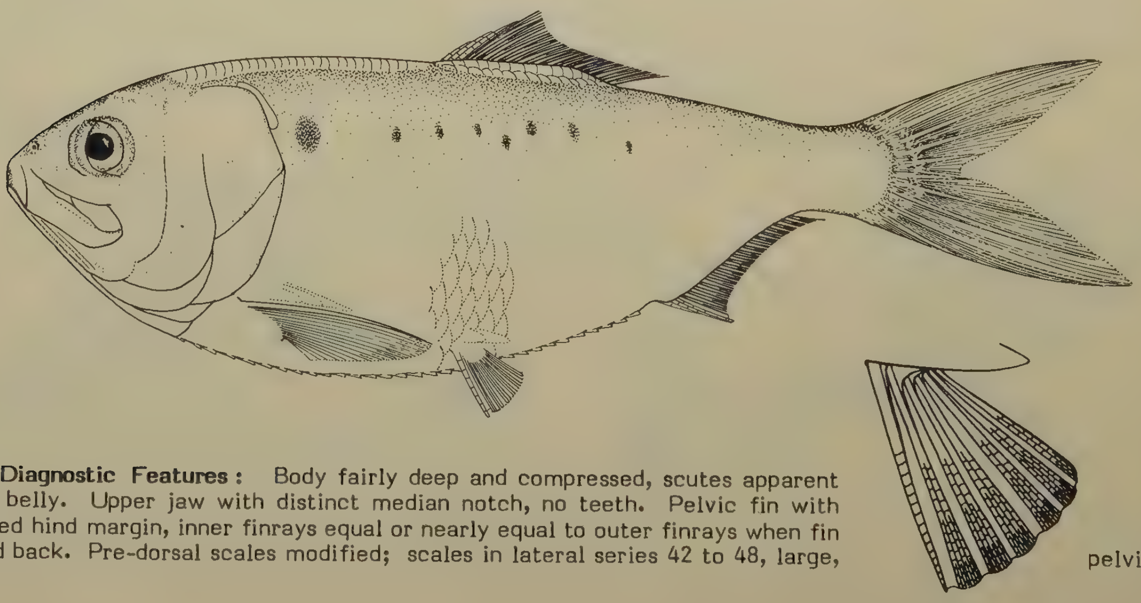
Brevoortia patronus Goode, 1878

CLUP Brevo 1

Brevoortia patronus Goode, 1878, Proc.U.S.natn.Mus., **1**:39 (Brazos Santiago, Texas, but in part also "Mouth of the Rio Grande").

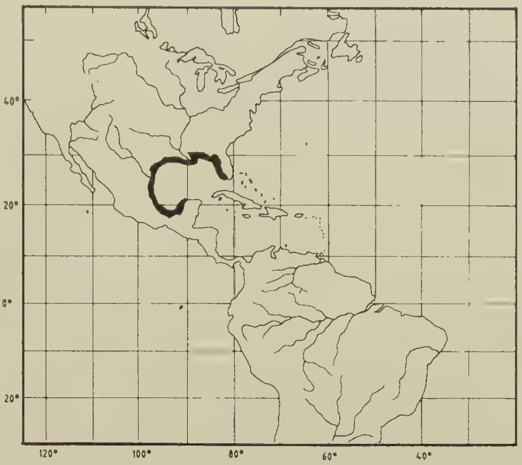
Synonyms : Brevoortia patronus - Hildebrand, 1948:13, fig. 3 (key, descr., biol., etc.); Suttkus, 1956:390, figs 1-20 (Louisiana, early life history); Idem, 1958:402 (distr.); Christmas & Gunter, 1960:338 (distr.); Suttkus & Sundararaj, 1961:177 (reprod.); FWNA, 1964:365, fig. 91 (key, descr., biol., etc.); Dahlberg, 1970:102, fig. 2 (photo) (key, descr., refs); Swift, Yerger & Parrish, 1977:21 (lower Ochlockonee River, Florida).

FAO Names : En - Gulf menhaden.



Diagnostic Features : Body fairly deep and compressed, scutes apparent along belly. Upper jaw with distinct median notch, no teeth. Pelvic fin with rounded hind margin, inner finrays equal or nearly equal to outer finrays when fin folded back. Pre-dorsal scales modified; scales in lateral series 42 to 48, large, those on back and above anal fin base only a little smaller and more irregular than rest. A black spot behind gill opening, followed by a series of spots along flank and often further spots above and below. Overlaps B. gunteri in range, but that species has more scales (60 to 77) and more pointed pelvic fins (inner rays markedly shorter than outer when fin folded back), also no line of spots on flank (the same characters separate it from B. smithi of Gulf coasts of Florida). Other clupeids lack the modified pre-dorsal scales. See CLUP Brevo 1, Fishing Area 31.

Geographical Distribution : Gulf of Mexico (Florida Bay, Gulf of Campeche, Mexico), but no certain records from Caribbean.



Habitat and Biology : Marine, pelagic, schooling, inshore in summer, but at least some moving out into deeper waters from October (Mississippi delta area), although adults have been recorded near shore in winter (Gulf coast of Florida); euryhaline, the commercial catch mostly in salinities of 5 to 24^{0}/oo, but also in fully salt water and up to 60^{0}/oo in the hypersaline Laguna Madre, Texas, and down to 0.1^{0}/oo in Grand Lake, Louisiana. Feeds in dense schools, filtering phytoplankton, but probably also feeds at bottom (mud in stomach). Apparently breeds in winter (October to February suggested by Suttkus, 1956, based on larvae entering Lake Pontchartrain, Louisiana in December to March; a peak in January fide Suttkus & Sundararaj, 1961, based on gonad states off the Louisiana coast).

Size : 25 cm standard length, usually about 20 cm.

Interest to Fisheries : Probably contributes the major part of the Gulf of Mexico menhaden catches. The total catch in 1983 was 923 585 tons.

Local Names : USA: Largescale menhaden.

Literature : See synonymy, of which Hildebrand (i.e. FWNA, 1964) and Dahlberg (1970) are the best summaries.

Remarks : Hybrids with B. smithi were described by Dahlberg (1970 - common).

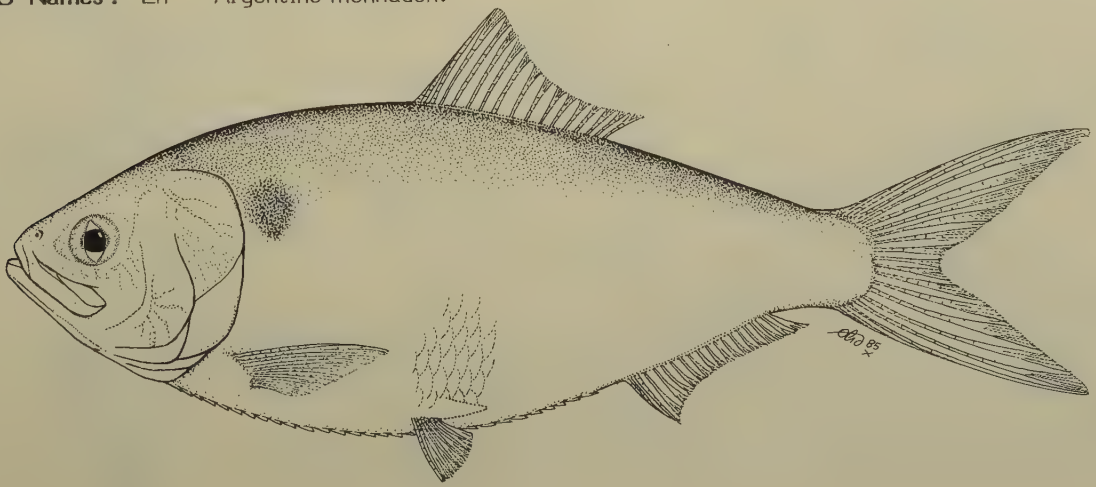
Brevoortia pectinata (Jenyns, 1842)

CLUP Brevo 6

Alosa pectinata Jenyns, 1842, Zool.voy.Beagle, fishes:135, pl. 25 (Bahia Blanca, Argentina).

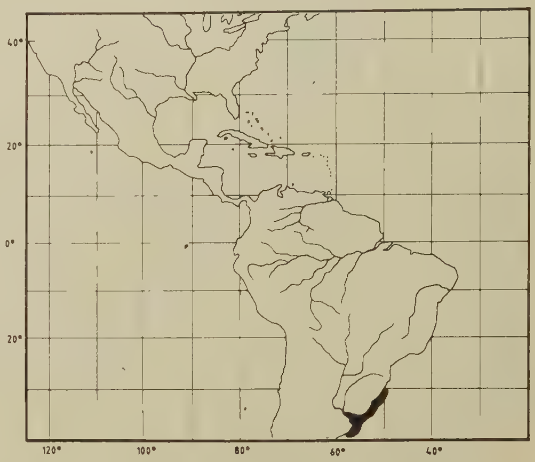
Synonyms : Brevoortia pectinata - Hildebrand, 1948:21, fig. 4 (Brazil, Uruguay, Argentina); FWNA, 1964:345 (in key only); Figueiredo & Menezes, 1978:24, fig. 28 (São Paulo to Argentina, probably on refs only); Menni, Ringuelet & Arámburu, 1984 (Argentina, on refs).

FAO Names : En - Argentine menhaden.



Diagnostic Features : Body deep and compressed, scutes apparent along belly. Upper jaw with distinct median notch, no teeth. Pectoral fin tip to pelvic fin base or at most short by the width of 3 scales; pelvic fin with oblique and almost straight hind margin. Pre-dorsal scales modified; scales in lateral series 35 to 46, those on back and above base of anal fin not markedly smaller than rest. A black spot behind gill opening, but none along flank. Closely resembles B. aurea, which has more scales in lateral series (48 to 56) and pectoral fin tip short of pelvic fin base by width of 3 to 7 scales. Other Brevoortia species occur only to north of Brazil. Other clupeids lack the modified pre-dorsal scales.

Geographical Distribution : Brazil (apparently off Rio Grande do Sul, but needs confirmation), Uruguay (Uruguay River and Montevideo fide Hildebrand, 1948:24) and Argentina (Buenos Aires, Río de la Plata fide Hildebrand, loc.cit., thus confirming Berg, 1895:18).



Habitat and Biology : Marine, pelagic, schooling, abundant in winter in La Plata region and entering rivers, but not above brackishwater (Berg, 1895). No data on food. In Lagõa dos Patos (southern Brazil) eggs were found mainly in spring and summer, in high salinity waters, but the larvae tolerate low salinities also.

Size : To 30 cm standard length.

Interest to Fisheries : Perhaps of some local importance, but recorded catches for 1983 were only 29 tons (Uruguay).

Local Names : ARGENTINA: Lacha.

Literature : Weis & Krug (1977 - eggs and larvae in Lagõa dos Patos).

Remarks : More work needed to separate it from B. aurea and clarify if their ranges really overlap.

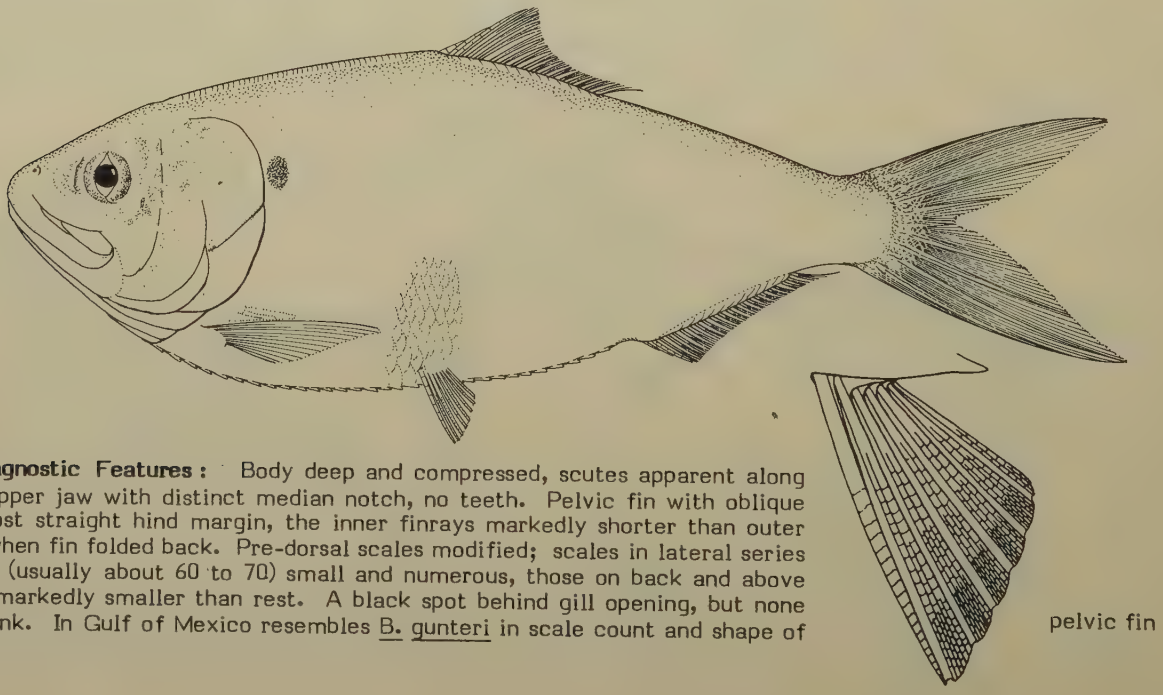
Brevoortia smithi Hildebrand, 1941

CLUP Brevo 2

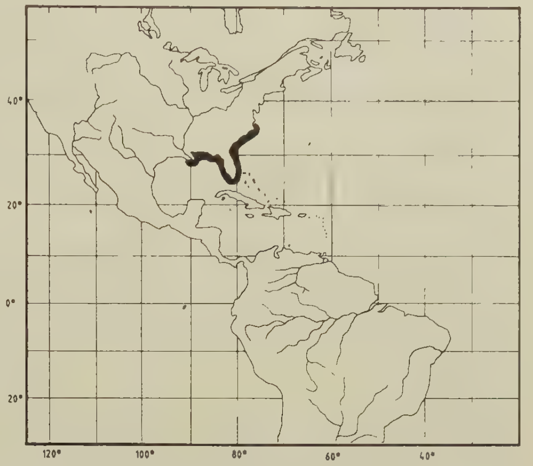
Brevoortia smithi Hildebrand, 1941, Copeia, (4):224 (Beaufort, North Carolina).

Synonyms : Brevoortia smithi - Hildebrand, 1948:28, fig. 6 (key, descr., biol., etc.); Christmas & Gunter, 1960:341 (Gulf of Mexico westward to Louisiana); Reintjes, 1962:93 (Sebastian, Florida, eggs and larvae); FWNA, 1964:372, fig. 92 (key, descr., biol., etc.); Dahlberg, 1970:104, fig. 1 (photo) (key, descr., refs).

FAO Names : En - Yellowfin menhaden.



Diagnostic Features : Body deep and compressed, scutes apparent along belly. Upper jaw with distinct median notch, no teeth. Pelvic fin with oblique and almost straight hind margin, the inner finrays markedly shorter than outer finrays when fin folded back. Pre-dorsal scales modified; scales in lateral series 54 to 80 (usually about 60 to 70) small and numerous, those on back and above anal fin markedly smaller than rest. A black spot behind gill opening, but none along flank. In Gulf of Mexico resembles B. gunteri in scale count and shape of pelvic fins, but that species has only 27 to 29, rarely 30 scutes (30 to 32 in B. smithi) and the pectoral fin tip short of pelvic fin base by width of 1 or 2 scales (cf. by 3 to 5 scales). Off Atlantic coasts resembles B. tyrannus, which has fewer scales (usually about 45 to 52) and spots along flanks (the same criteria separate it from B. patronus of Gulf). Other clupeids lack the modified pre-dorsal scales. See CLUP Brevo 2, Fishing Area 31.



Geographical Distribution : Atlantic coast (from Beaufort, North Carolina, to Indian River, Florida); Gulf of Mexico (Florida Bay to Louisiana, with possible break between Biscayne Bay and Florida Bay).

Habitat and Biology : Marine, pelagic, schooling (but perhaps not in northern part of range), inshore and in bays and estuaries; occurs in brackishwater. Feeds by filtering phytoplankton. Breeds in winter (eggs and larvae in plankton), probably November through to February or March (no data from Gulf of Mexico).

Size : To 29 cm standard length, usually about 20 cm.

Interest to Fisheries : Not of much importance. Less oily than B. tyrannus.

Local Names : -

Literature : Reintjes (1962 - eggs and larvae); Hildebrand (i.e. FWNA, 1964 - synopsis); Dahlberg (1970 - synopsis); Houde & Swanson (1975 - eggs and larvae).

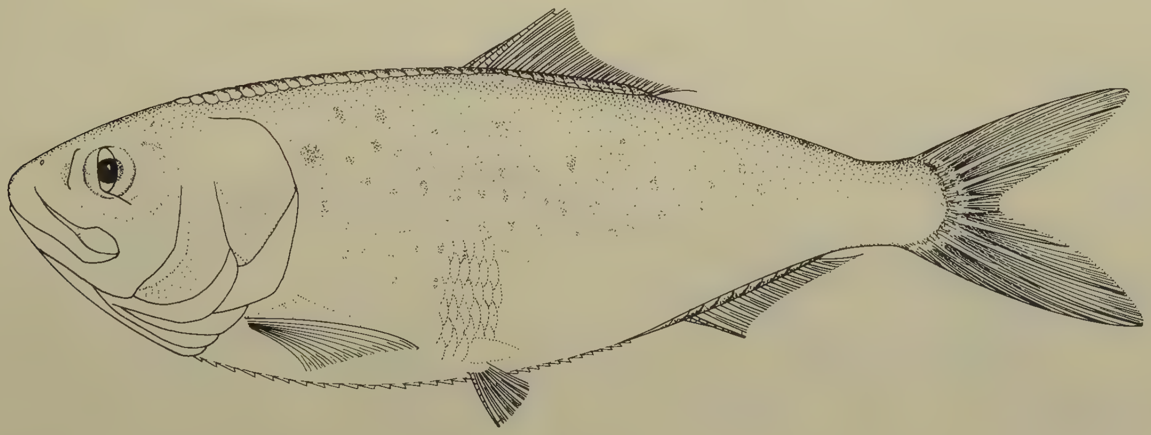
Remarks : Hybrids with B. tyrannus and with B. patronus were described by Dahlberg (1970 - both hybrids common).

Brevoortia tyrannus (Latrobe, 1802) CLUP Brevo 3

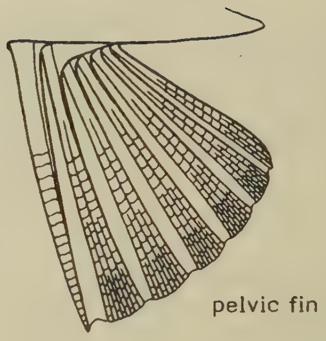
Clupea tyrannus Latrobe, 1802, Trans.Am.Phil.Soc., 5:77, pl. 1 (Chesapeake Bay; no descr., dorsal fin missing).

Synonyms : Clupea menhaden Mitchill, 1814:21 (presumed New York); Clupea carolinensis Gray, 1854:140 (South Carolina,; on Ms name and description by Gronovius); Hildebrand, 1948:7, fig (key, descr., biol., etc.); FWNA, 1964:346, figs 86, 87, also 85 (scale), 88 (eggs and larvae), 89 (young) (key, descr., biol., etc.); Liem & Scott, 1966:93, fig. (Canada, infrequent); Reintjes, 1969:1, pl. (photo), fig. 1 (egg to juvenile) (synopsis of biol., fishery); Dahlberg, 1970:99, fig. 1 (photo) (key, descr., refs).

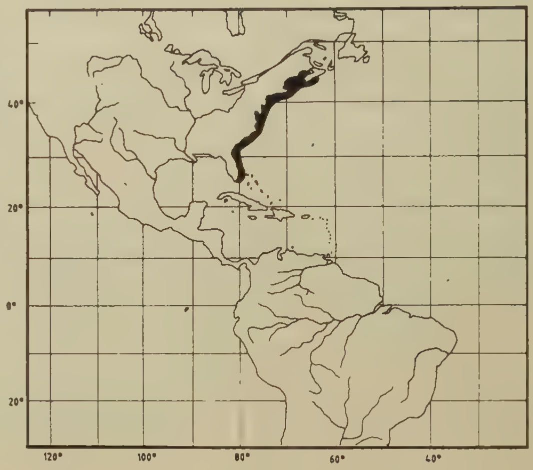
FAO Names : En - Atlantic menhaden.



Diagnostic Features : Body deep and compressed, scutes apparent along belly. Upper jaw with distinct median notch, no teeth. Pelvic fin with rounded hind margin, inner finrays equal or nearly equal to outer finrays when fin folded back. Pre-dorsal scales modied; scales in lateral series 40 to 58 (usually about 45 to 52), those on back, above base of anal fin and at base of tail much smaller and irregularly placed. A black spot behind gill opening, followed along flank by a variable number of smaller spots forming up to 6 approximate lines. Easily distinguished from *B. smithi*, which has 54 to 80 (usually about 60 to 70) scales and no lines of spots on flank. Other *Brevoortia* species do not overlap in range. Other clupeids lack the modified pre-dorsal scales. See CLUP Brevo 3, Fishing Area 31.



Geographical Distribution : Atlantic coasts (Nova Scotia southward to Indian River, Florida).



Habitat and Biology : Marine, pelagic, schooling, inshore in summer, but at least some moving into deeper water in winter (but perhaps not in south of range); forms large and very compact schools, both of adults and juveniles (good aerial photo in Reintjes, 1969:fig. 3); north/south migrations (spring and summer *versus* autumn) occur, as also short-term migrations in and out of bays and inlets depending on tides, season and weather. Feeds by filtering phyto- and zooplankton (diatoms, copepods, euphausids). Breeding season apparently limited by high water temperatures (20.5°C monthly mean maximum), spawning probably throughout year: spring spawners (April/May) in Cape Cod and Long Island waters, autumn spawners (October/November) from Long Island to North Carolina (plus some spawning June to August), probably winter spawners off Florida (December to March); nursery areas in estuaries.

Size : To about 38 cm standard length (reported to 50 cm total length), usually about 18 cm and 28 cm fork length in fisheries of northern and southern parts respectively.

Interest to Fisheries : The most important of the Atlantic coast menhadens, with a total catch in 1983 of 420 345 tons. Commercially caught by purse seines, but small numbers taken by other gear (pound nets, gillnets, etc.); the schools are often located from the air (see Reintjes, 1969, for good summary of fishing methods). Fishes principally used for production of oil and for fertilizer and fishmeal.

Local Names : USA: Bugfish, Bunker, Fatback, Menhaden, Mossbunker.

Literature : Extensive (see Reintjes, 1964), but well summarized by Hildebrand (i.e. FWNA, 1964) and Reintjes (1969).

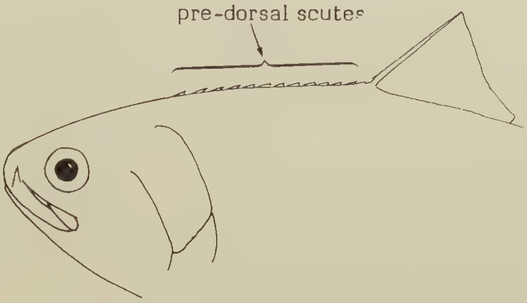
Remarks : Hybrids with *B. smithi* described by Dahlberg (1970).

Ethmidium Thompson, 1916

CLUP Ethm

Ethmidium Thompson, 1916, Proc.U.S.natn.Mus., **50**:458 (type: Clupea (Alosa) notacanthoides Steindachner = Alausa maculata Valenciennes).

Diagnostic Features : Moderate-sized herring-like fishes (to about 30 cm standard length), fairly deep and compressed, with a keel of scutes along belly; a complete series of scutes also present on back, from occiput to dorsal fin. Upper jaw with a distinct median notch. Gillrakers long, fine and numerous, those of upper arch folding down over lower gillrakers at angle of first arch. Pelvic finrays i 6; anal fin short, well behind dorsal fin base. Scales adherent, hind border denticulate, about 50 to 60 in lateral series. Dark spots on flanks, usually vertically oval. Species of Sardinops have spots on the flanks, but are more slender, lack the notched upper jaw and have radiating bony striae on the operculum; Strangomera is also more slender and lacks the notch, also no spots on flank and pelvic finrays i 7.



Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : Modern authors have recognized a single species, at most considering Hildebrand's E. chilcae as a subspecies:

E. maculatum (Valenciennes, 1847), eastern South Pacific.

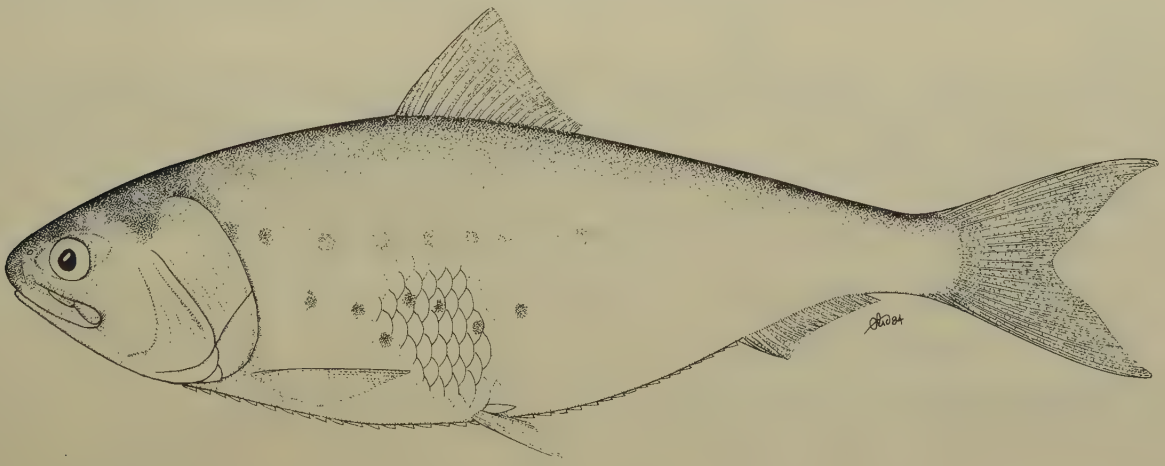
Ethmidium maculatum (Valenciennes, 1847)

CLUP Ethm 1

Alausa maculata Valenciennes, 1847, Hist.nat.poiss., **20**:430 (Valparaiso, Chile).

Synonyms : ? Alausa coerulea Valenciennes, 1847:432 (Valparaiso, Chile; in part on drawing); Clupea notacanthus Günther, 1868:443 (Valparaiso); Delfin, 1901:39 (on Günther); Clupea (Alosa) notacanthoides Steindachner, 1869:309, pl. 7 (Mazatlan - error); Clupea maculata:Delfin, 1901:39 (Tomé, Valparaiso, Iquiqui); Ethmidium chilcae Hildebrand, 1946:82, fig. 17 (Chincha Island, Callao and Pisco Bay, Peru); Brevoortia (Ethmidium) maculata:De Buen, 1958:98, fig. 2 (gillrakers) (Valparaiso); Brevoortia maculata chilcae:Chirichigno, 1963:15, fig. 7 (photo) (Pta Pizarro, Peru); Ethmidium maculatum - Fowler, 1945:4 (full refs); Mann, 1954:133, fig. (Arica to Talcahuano, Chile); Whitehead, 1967:88 et seq. (types of maculata, coerulea); Idem, 1970:18 (type of notacanthoides lost); Boré & Martinez, 1981:unpaged, fig. (photo) (Arica to Talcahuano, Chile); Leible & Alveal, 1982:16, figs 1-3 (same range); Whitehead & Bauchot, in press (types of maculata, coerulea, the latter lost).

FAO Names : En - Pacific menhaden.



Diagnostic Features : Body fairly deep, compressed, scutes present along back (before dorsal fin) as well as along belly. Upper jaw with median notch; no teeth. Gillrakers fine and slender, about 130 to 150 in lower limb. Pelvic finrays i 6; anal fin short, with iii 12 to 15 finrays, well behind last dorsal finray. Scales with pectinated hind border. A dark spot behind gill cover and up to 4 series of vertically oval spots along flank. Distinguished from all other clupeids in the area (Opisthonema, Harengula, Lile in north; Strangomera, Sardinops in south) by the notched upper jaw and pre-dorsal scutes; spots are absent in all except Sardinops, which is also more slender and has a striated operculum.

Geographical Distribution : Peru (Puerto Pizarro at 3°34'S in Gulf of Guayaquil to Callao and Pisco Bay; presumably to border with Chile, but no records) and Chile (whole coast south to Talcahuano at 36°40'S).

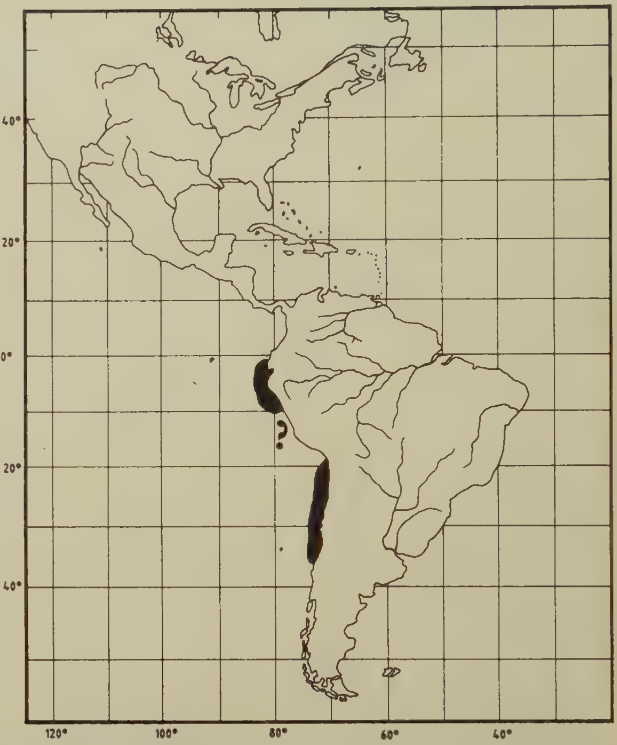
Habitat and Biology : Marine, pelagic, coastal, forming large schools. Feeds by filtering phytoplankton (diatoms, etc.) and zooplankton (especially copepods), but will also take small fishes and crustaceans (fide Leible & Alveal, 1982). Breeds in spring (Chile), depositing its eggs in coastal waters on sand, to which the sticky eggs cling, the larvae rising and joining the surface plankton on hatching.

Size : To about 26 cm standard length, 35 cm total length.

Interest to Fisheries : A moderate contribution to clupeoid catches in the area, the total catch in 1983 being 6 213 tons (Peru 2 100 tons, Chile 4 113 tons). Caught by purse seines, both by commercial fleets and by artisanal fishermen. In 1978, 74.4% of the catch went for reduction, 21.8% was not processed, 2.7% was canned and 0.1% was frozen (Boré & Martinez, 1981).

Local Names : -

Literature : Leible & Alveal (1982 - synopsis).



Remarks : Authors have often recognized a Peruvian subspecies (chilcae of Hildebrand) as distinct from the Chilean form (maculatum); Mann (1954:134) stated that the geographic division between the subspecies was at Antofagasta, Chile. Because of size differences in the material studied by Hildebrand and others, Whitehead (1970:19) doubted that body depth, pectoral length and scale form could separate the subspecies, although there might be a slight difference in head length. More work is needed.

Ethmalosa Regan, 1917

CLUP Eth

Ethmalosa Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:302 (type: Alausa dorsalis Valenciennes = Clupea fimbriata Bowdich).

Diagnostic Features : Moderate-sized herring-like fishes (to 35 cm standard length), fairly deep and compressed, with a keel of scutes along the belly. Upper jaw with a distinct median notch. Gillrakers long, fine and numerous; upper gillrakers of first arch not overlapping lower gillrakers at angle of arch, the upper rakers strongly bent, V-shaped. Pelvic finrays i 7; anal fin well behind dorsal fin base. Scales adherent, hind border denticulate. Species of Sardinella have the upper jaw rounded, not notched, in the midline; also, the upper gillrakers are not V-shaped.

Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : A single species recognized:

E. fimbriata (Bowdich, 1825), West Africa.

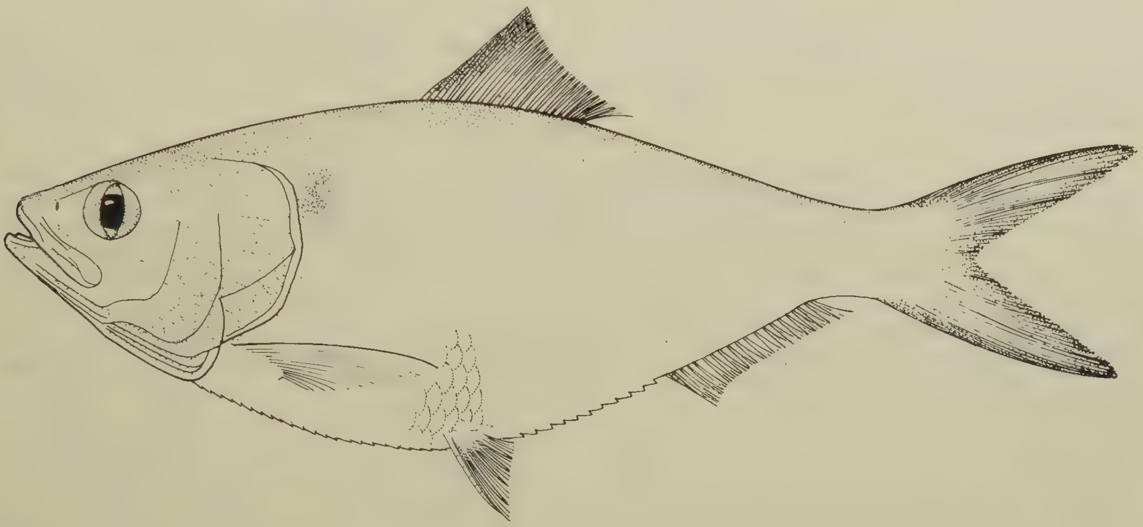
Ethmalosa fimbriata (Bowdich, 1825)

CLUP Eth 1

Clupea fimbriata Bowdich (S.), in Bowdich (T.E.), 1825, Excurs.Madeira:234, fig. 44 (claimed Praia, S. Tiago, Cape Verde Islands, but most likely Gambia).

Synonyms : Harengula forsteri Valenciennes, 1847:299 (S. Tiago, Cape Verde Islands - probably on Bowdich); Meletta senegalensis Valenciennes, 1847:418 (Senegal); Alausa dorsalis Valenciennes, 1847:418 (Gorée, Senegal); Alausa platycephalus Bleeker, 1863:123 (Ghana); Clupea setosa Steindachner, 1870:311, pl. 6 (Liberia, Gabon); Ethmalosa dorsalis:Longhurst, 1971:353, 356 (West Africa, synopsis, biol., fishery); Ethmalosa fimbriata -Fowler, 1936:175, fig. 70 (Gambia, Congo River mouth); Whitehead, 1967:85 (types etc. of forsteri, senegalensis, dorsalis); Idem, 1970:17 (types of setosa); CLOFFA, 1984:42 (all refs in freshwater); CLOFETA, in press (all marine and freshwater refs); Whitehead & Bauchot, in press (types etc. of forsteri, senegalensis, dorsalis).

FAO Names : En - Bonga shad.

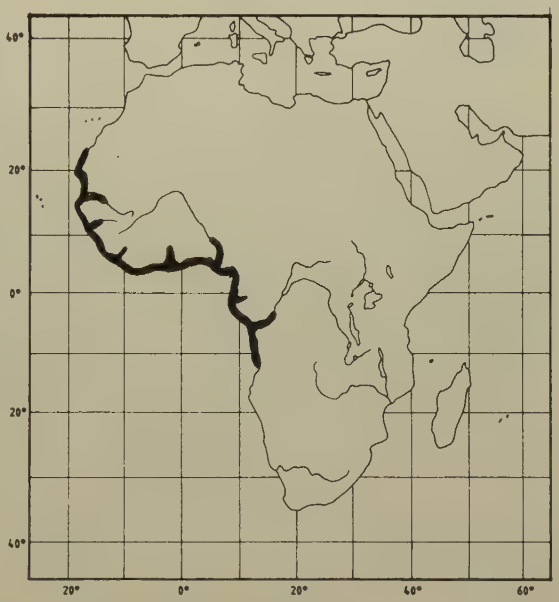


Diagnostic Features : Body fairly deep, compressed, scutes present along belly. Upper jaw with distinct median notch, into which tip of lower jaw fits. Lower gillrakers long, fine and numerous, about 3 times as long as gill filaments, upper gillrakers bent sharply upward, V-shaped. Pelvic finrays i 7; caudal fin tips long and pointed. A faint dark spot behind gill cover (sometimes followed by others); dorsal fin tip black; caudal fin deep chrome yellow; golden tints on body. Resembles Sardinella aurita, S. rouxi and especially S. maderensis, but these are more slender, have a rounded upper jaw (not notched) and the upper gillrakers are not bent upward like an elbow. Alosa species do not overlap E. dorsalis in the north of its range (also upper gillrakers not bent, pelvic finrays i 8). See CLUP Ethm 1, Fishing Areas 34, 47 (in part).

Geographical Distribution : Eastern central Atlantic (Dakhla, western Sahara, to at least Lobito, Angola - i.e. from 24^{0}N to 12^{0}S; dwarf population in Lake Nokoué, Benin). Records from Cape Verde Islands based on erroneous type locality for E. fimbriata by Bowdich - followed by later authors.

Habitat and Biology : Euryhaline, inshore waters, also lagoons and more than 300 km up rivers (e.g. Gambia River, where they move down during flooding, but up again during intrusion of seawater in the dry season). Feeds by filtering phytoplankton, chiefly diatoms (full analysis by Bainbridge, 1963). Breeds throughout year in waters of salinities 3.5 to 38^{0}/oo, but with peaks in at least some areas (March, June/July and October/November at mouth of Gambia River - see Scheffers & Conand, 1976; July to September off Sierra Leone; November to May/June off Ivory Coast and Nigeria, i.e. progressively later to south); spawns in the sea, in estuaries and in rivers.

Size : To 35 cm standard length, usually about 20 to 25 cm.



Interest to Fisheries : The largest fisheries are in Senegal, Sierra Leone, Ivory Coast, Nigeria and Cameroun, mainly in the dry season. Total carches for 1983 were 88 121 tons (Nigeria 31 622, Sierra Leone 21 127 tons, Ivory Coast 14 618 tons). Caught by canoe fishermen using purse seines and encircling nets, also seine nets in lagoons and estuaries. Marketed fresh, also smoked and dried (the latter greatly preferred in Cameroun and perhaps elsewhere, but the Senegambian catch is mostly marketed fresh).

Local Names : WEST AFRICA: Bonga.

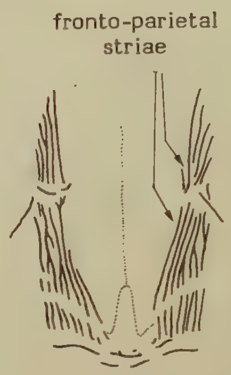
Literature : Bainbridge (1963 - food); Scheffers & Conand (1976 - Senegambian region - biol.); Whitehead (i.e. CLOFETA, in press - all refs to 1984).

Hilsa Regan, 1917

CLUP Hils

Paralosa Regan, 1916, Ann.Durban Mus., 1(3):167 (type: Clupea durbanensis Regan = Clupea kelee Cuvier; pre-occupied by Paralosa Bleeker, 1868 = Sardinella). Hilsa Regan, 1917, Ann.Mag.nat.Hist., (8)9:303 (type: Clupea durbanensis Regan; to replace Paralosa Regan, 1916). Macrura Fowler, 1941, Bull.U.S.natn Mus., (100):626 (type: Clupea kelee Cuvier).

Diagnostic Features : Moderate-sized herring-like fishes (to 25 cm standard length, but usually to about 20 cm), fairly deep and compressed, with a keel of scutes along belly. Top of head with numerous longitudinal striae (fronto-parietal striae); upper jaw with a distinct median notch. Gillrakers fine and numerous, those on inner arches curled outward. Pelvic finrays i 7; anal fin short, well behind dorsal fin base. Scales moderate, 39 to 44 in lateral series, perforated. Resembles Tenualosa, which lacks striae on top of head, has more or less straight gillrakers on inner arches and no perforations on scales; species of Sardinella and Herklotsichthys have the upper jaw rounded, not notched, in the midline; gizzard shads (Nematalosa, etc.) have an inferior mouth and have a filamentous last dorsal finray.



top of head

Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : A single species recognized:

H. kelee (Cuvier, 1829), Indo-West Pacific.

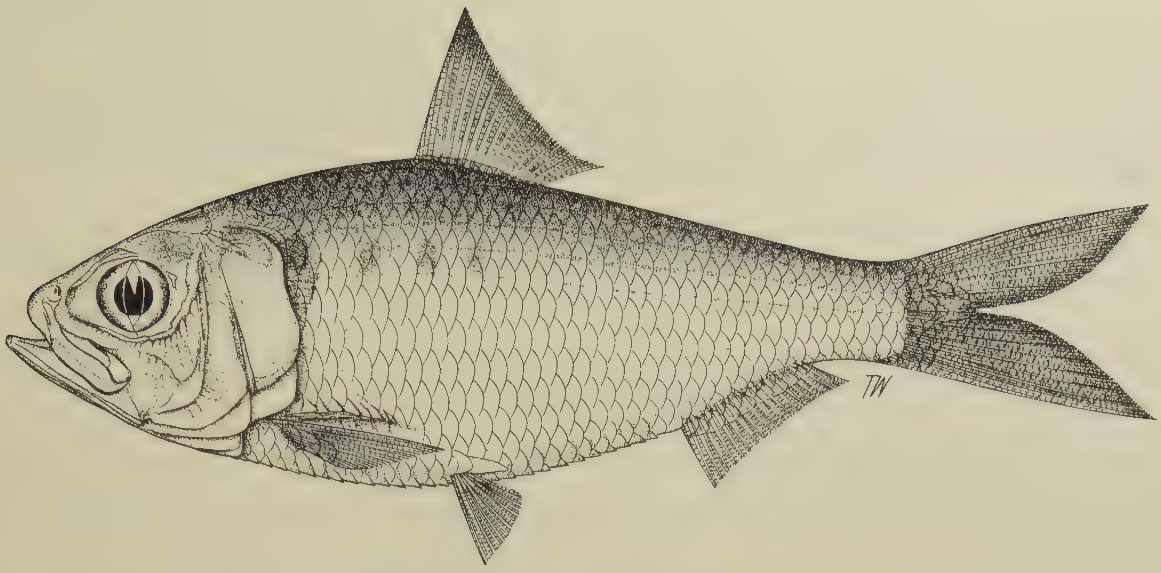
Hilsa kelee (Cuvier, 1829)

CLUP Hils 1

Clupea kelee Cuvier, 1829, Règne animal, 2nd ed., 2:320 (on keelee of Russell, 1803; Vizagapatnam).

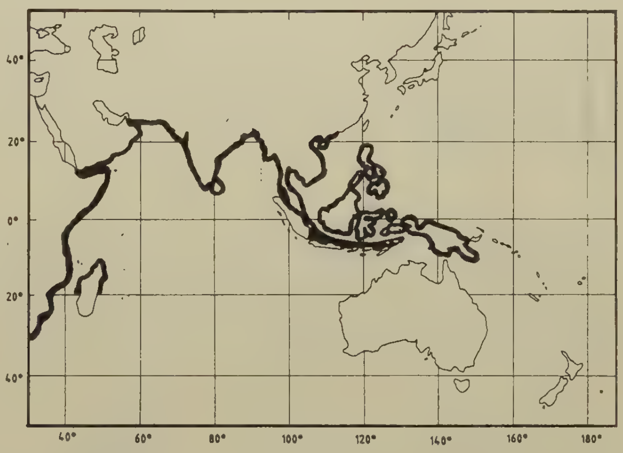
Synonyms : Clupea sinensis:Bloch, 1795:38, pl. 405 (name taken from Linnaeus, 1758 = ? Tenualosa reevesii; Bloch's specimen is H. kelee ex Tranquebar); Clupeonia blochii Valenciennes, 1847:353 (on Bloch's sinensis); Alosa brevis Bleeker, 1848:638 (Bima, Sumbawa Island); Alausa kanagurta Bleeker, 1852:13, 34 (Jakarta, Muntok); Alausa brachysoma Bleeker, 1853:527 (Padang); Alosa malayana Bleeker, 1866:294 (Java, Sumatra); Clupea platygaster Günther, 1868:448 (Sumatra); Harengula (Paralosa) zeylanica Hubrecht, 1879 (nomen nudum); Clupea durbanensis Regan, 1906:4, pl. 4 (Durban Bay); Macrura kelee:Fowler, 1941:627-629 (also Macrura brevis, M. durbanensis); Macrura brevis:Munro, 1967:53, pl. 5, fig. 59 (Papua New Guinea); Hilsa kelee - Whitehead, 1965:129 (revision); Whitehead et al., 1966:79, 80, pl 10, fig. 1 (types of zeylanica, malayana, brachysoma, brevis, kanagurta); Whitehead, 1967:90, 91 (types of kelee, blochii); Idem, 1969:267, pl. 1c (Bloch's sinensis); Idem, 1973b:197, fig. 26 (key, synonymy, refs); Wongratana, 1980:156, pls 102, 103 (revision); SFSA, in press (South Africa); Whitehead & Bauchot, in press (types of kelee, blochii).

FAO Names : En - Kelee shad.



Diagnostic Features : Body fairly deep and compressed, belly with distinct keel of scutes. Top of head with numerous fronto-parietal striae; upper jaw with median notch. Gillrakers about 100 to 175, those on inner arches distinctly curled; outer row of gill filaments on first arch not more than half length of gillrakers. A series of small triangular scales above axil of pectoral fin; hind part of body scales perforated. A black spot behind gill cover, usually followed by up to 10 spots along flank. Deep-bodied *Sardinella* species have no notch in midline of upper jaw and no spots along flank; species of *Tenualosa* have no fronto-parietal striae, more or less straight gillrakers on inner arches and no perforations on scales; gizzard shads (*Nematalosa*, *Anodontostoma*) have an inferior mouth. See CLUP Hils 1, Fishing Area 51, also 57, 71.

Geographical Distribution : Indo-West Pacific (probably all coasts of Indian Ocean, from Gulf of Oman and Gulf of Aden south to Durban and Madagascar, across the Bay of Bengal, Gulf of Thailand, Java Sea and north to Hong Kong and east to Papua New Guinea and possibly further).



Habitat and Biology : Marine, pelagic, but entering estuaries and able to tolerate quite low salinities (7^{o}/oo). Feeds chiefly on phytoplankton (mainly diatoms, also dinoflagellates), but also copepods, molluscan and crustacean larvae, prawns, amphipods and polychaetes (Godavari estuary, Babu Rao, 1966). Spawns (at least in Godavari estuary) around February (Babu Rao, *loc. cit.*).

Size : To 24.4 cm standard length, usually about 15 to 18 cm.

Interest to Fisheries : Apparently does not form large schools, but enters artisanal fisheries (e.g. in Godavari estuary, eastern coast of India).

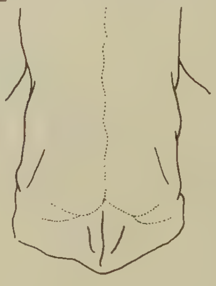
Local Names : KENYA: Makrange, Pawali.

Literature : Whitehead (1973b - refs); Babu Rao (1966 - biol. in Godavari estuary).

Tenualosa Fowler, 1934

CLUP Tenu

Tenualosa Fowler, 1934, *Proc.Acad.nat.Sci.Philad.*, **85**:246 (type: *Alosa reevesii* Richardson). *Macrura* Fowler, 1941, *Bull.U.S.natn.Mus.*, (100):626 (type: *Clupea kelee* Cuvier; genus wrongly attributed to van Hasselt, 1823 by Fowler). *Hilsa* (part): virtually all authors included the species of *Tenualosa* in *Hilsa* until the latter was recently restricted to *H. kelee* by Wongratana (1983:385).


top of head

Diagnostic Features : Moderate or large herring-like fishes (to 50 cm standard length in one species), moderately elongate but compressed, with a keel of scutes along belly. Top of head without numerous longitudinal striae (fronto-parietal striae); upper jaw with a distinct median notch. Gillrakers fine and numerous, those on the inner arches more or less straight, not curled outward. Pelvic finrays i 7; anal fin short, well behind dorsal fin base. Scales moderate, 37 to 47 in lateral series, hind part without perforations. Resembles *Hilsa*, which has numerous striae on top of head, has the gillrakers on the inner arches curled outward and perforations on scales; gizzard shads (*Nematalosa*, etc.) have an inferior mouth and most have a filamentous last dorsal finray. Other clupeids have no notch in the upper jaw.

Biology, Habitat and Distribution : Anadromous or riverine shads of the Indo-West Pacific region, from "the Gulf" to China.

Interest to Fisheries : All contribute to artisanal fisheries, but *Hilsa ilisha* and to a lesser extent *H. toli* are of considerable importance (total catch for 1983 was 8 807 tons - recorded as *Hilsa ilisha* and *H. toli*).

Species : Wongratana (1980, 1983) recognized 5 species:

T. ilisha (Hamilton-Buchanan, 1822), northern Indian Ocean
T. macrura (Bleeker, 1852), Indonesia
T. reevesii (Richardson, 1846), China to Andaman Sea
T. thibaudeaui (Durand, 1940), Mekhong River
T. toli (Valenciennes, 1847), India to Indonesia.

Tenualosa ilisha (Hamilton-Buchanan, 1822)

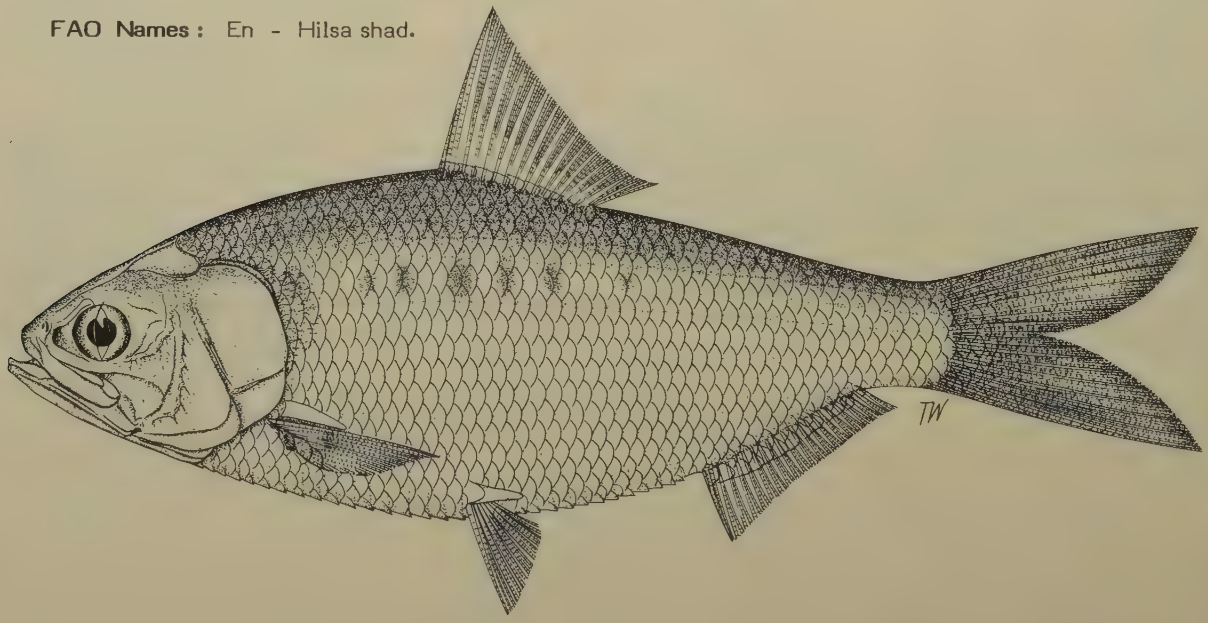
CLUP Tenu 1

Formerly CLUP Hils 2

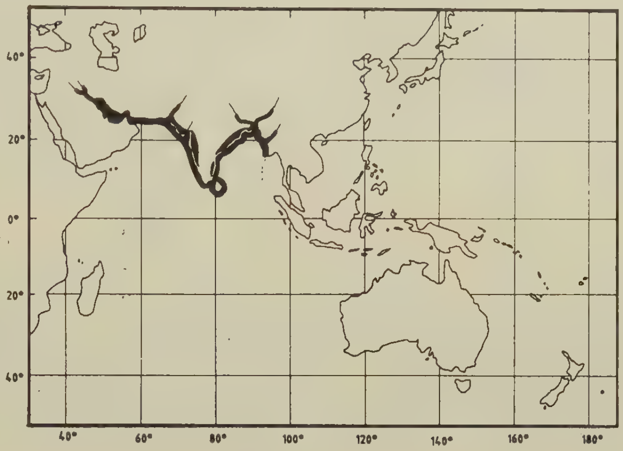
Clupanodon ilisha Hamilton-Buchanan, 1822, *Fishes of Ganges*:243, 382, pl. 19, fig. 73 (Ganges estuaries).

Synonyms : *Clupea palasah* Cuvier, 1829:320 (on *Palasah* of Russell, 1803); *Macrura ilisha*:Fowler, 1941:633 (compiled); *Hilsa ilisha*:Rosa & Pillay, 1963; unpaged (synopsis, biol.); Whitehead, 1965:134, fig. 9 (revision); *Idem*, 1967:91 (types of *palasah*); *Idem*, 1973:199, fig. 27 (key, synonymy, refs); *Tenualosa ilisha* - *Wongratana*, 1980:164, pls 110, 111 (revision); Whitehead & Bauchot, in press (*palasah*).

FAO Names : En - Hilsa shad.



Diagnostic Features : Body moderately deep, compressed, belly with 30 to 33 scutes. Head length 28 to 32% of standard length; distinct median notch in upper jaw. Gillrakers fine and numerous, about 100 to 250 on lower part of arch. Caudal fin moderate, 25 to 31% of standard length. A dark blotch behind gill opening, followed by a series of small spots along flank. Resembles T. toli, which has a shorter head (22 to 27% of standard length), a longer caudal fin (31 to 34% of standard length), fewer gillrakers (60 to 100) and no spots along flank, also scutes 28 to 30. The notched upper jaw distinguishes it from other similar clupeids, except Hilsa kelee, which has numerous longitudinal striae on top of head. See CLUP Tenu 1, Fishing Area 51; also, CLUP Hils 2, Fishing Areas 57, 71.



Geographical Distribution : Northern part of Indian Ocean (from "the Gulf" eastward to Burma, including western and eastern coasts of India, also rivers).

Habitat and Biology : Marine, pelagic and schooling in coastal waters, euryhaline, anadromous, ascending rivers for as much 1200 km, but usually about 50 to 100 km. Feeds on plankton, mainly by filter-feeding, but apparently also by grubbing on muddy bottoms; diatoms, protozoans, crustaceans, molluscs and tunicates are recorded, as well as young Tenualosa (Pillay & Rosa, 1963). Breeds mainly in rivers, in some cases far up (about 400 km up the Mahanadi system, and even to Agra and Delhi or over 1000 km up the Ganges), but elsewhere only to about 50 km or less (younger fishes may breed in the tidal zone of rivers). In some rivers the migration is restricted by barrages; there is some evidence that Hilsa far up the Ganges and other large rivers, although migrating upstream to spawn, are permanent river populations that do not descend to the sea. The main breeding season is during the southwest monsoon, with a shorter season from January to February or March.

Size : To 60 cm standard length, commonly to 35 to 40 cm.

Interest to Fisheries : The most important of the Indo-Pacific shads, with a total catch in 1983 of 6 277 tons (West Pakistan 5 990 tons, Kuwait 287 tons). The fishes are mainly caught with traps, fishing weirs and drifted or fixed gillnets in estuaries and rivers during the upstream spawning migration; fishermen also use seine nets, bag nets, clasp nets and cast nets. The esteem in which the hilsa is held is reflected in Sanskrit and Bengali literature, where the fish is described as matsyaraja (king of fishes) and it is said that Illisah jitapiyusah (hilsa surpasses nectar).

Local Names : BURMA: Nga-tha-lauk; INDIA: Chaksi (Narbada River), Hilsa (Bengali, Hindi), Ilihi (Assam), Ilish, Ilisha (Bengal, Orissa), Oolum, etc. (Tamil), Palasah (Telugu), Pala, Palo, Pulla (Sindhi), Paliyah, Paluva, Valava (Malayalam), Palla (Marathi), Paliya (Canarese), Hilsa, Koira (juveniles, West Bengal), Jodi (juveniles, Chilka Lake); IRAN: Soboor; IRAK: Shour; PAKISTAN: Ilish, Jatka, Palla.

Literature : Pillay & Rosa (1963 - best summary of biology, fishery); Whitehead (1973 - additional references to biology).

Remarks : Authors have (probably correctly) suspected that individual populations are often isolated and that distinct races exist (reviewed by Pillay & Rosa, 1963). No overall study has yet been made the morphological characteristics of the various 'races'.

Tenualosa macrura (Bleeker, 1852)

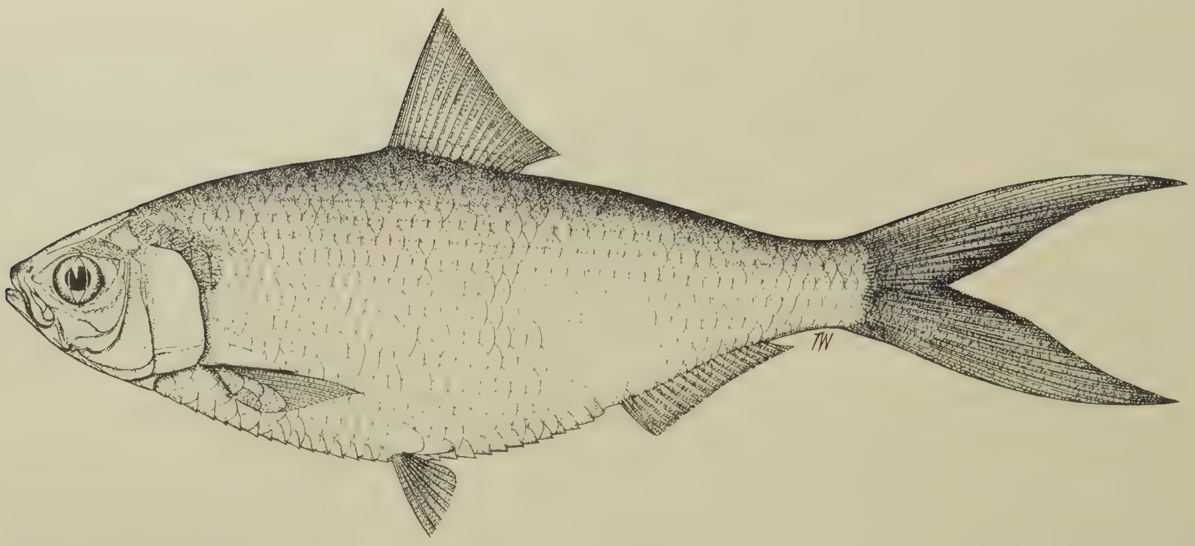
CLUP Tenu 3

Formerly CLUP Hils 3

Alausa macrurus Bleeker, 1852:31 (on macrura of Kuhl & van Hasselt, 1823 - Jakarta, Java).

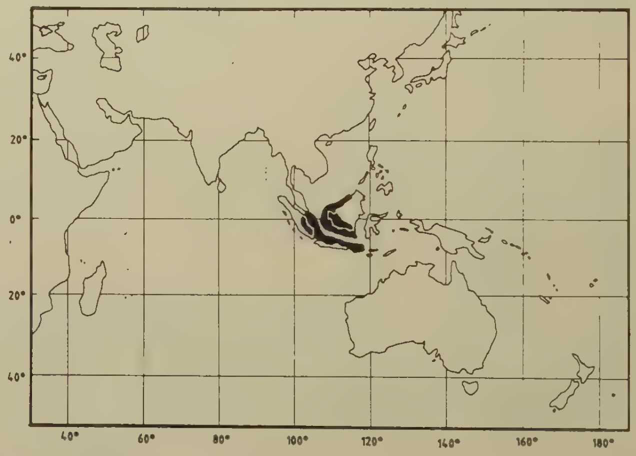
Synonyms : Macrura macrura:Fowler, 1941:632 (compiled); Hilsa macrura:Whitehead, 1965:141 (revision); Whitehead et al., 1966:86 (neotype for macrurus); Tenualosa macrura - Wongratana, 1980:162, pls 106, 107 (revision).

FAO Names : En - Longtail shad.



Diagnostic Features : Body moderately deep, compressed, belly with 30 to 31 scutes. Head length 22 to 25% of standard length; a distinct median notch in upper jaw. Gillrakers fine but not numerous, 60 to 75 on lower part of arch (barely increasing after 10 cm standard length). Caudal fin long, 40 to 42% of standard length, the lobes long and pointed. No series of dark spots along flanks. Resembles *T. toli*, which has a longer head (25 to 27% standard length), but shorter tail (only 31 to 34% standard length); *T. reevesii* has many more lower gillrakers (80 to 250) and a larger head (27 to 33% standard length). The notched upper jaw distinguishes it from other similar clupeids, except *Hilsa kelee*, which has numerous longitudinal striae on top of head, also spots along flank. See CLUP Hils 3, Fishing Areas 57, 71.

Geographical Distribution : Malaysia and Indonesia (Java Sea and Sarawak, also affluent rivers).



Habitat and Biology : Marine, pelagic and schooling in coastal waters, euryhaline, anadromous, ascending rivers to breed. Presumably its biology is similar to that of *T. ilisha*, but the fewer gillrakers suggest that it takes larger food organisms.

Size : To 52 cm standard length.

Interest to Fisheries : Perhaps more important locally than the records imply. Indonesian records (as *Hilsa toli*) gave a total of 2 530 tons in 1983.

Local Names : INDONESIA, MALAYSIA: Trubu, Trubuk.

Literature : There seems to be no modern study of the biology of this species.

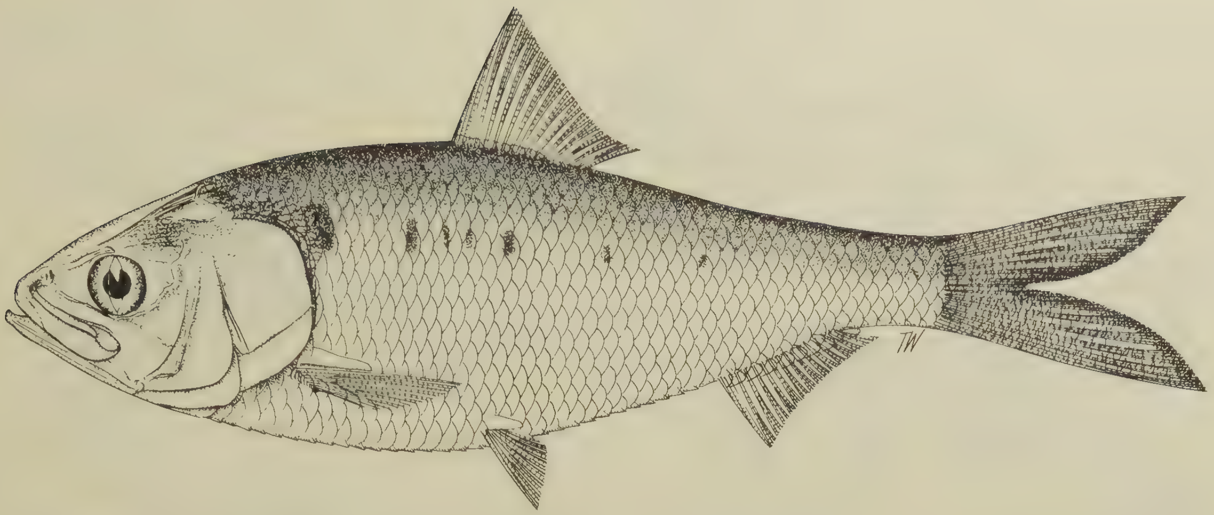
Tenualosa reevesii (Richardson, 1846)

CLUP Tenu 4

Alosa reevesii Richardson, 1846, *Ichthyol.China Japan*:305 (China, in fact Canton or Macao).

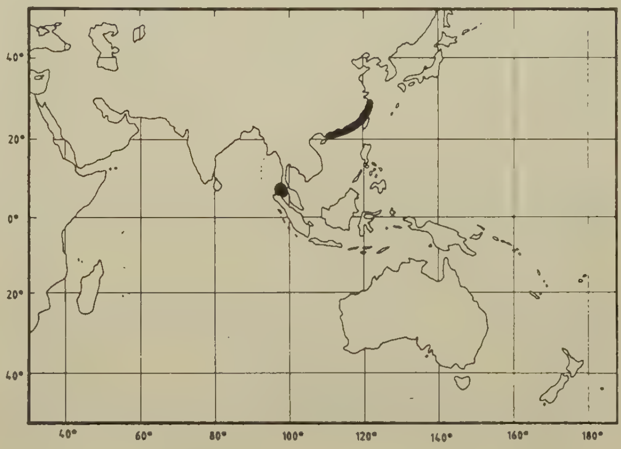
Synonyms : ? *Clupea sinensis* Linnaeus, 1758:319 (identity uncertain, best considered a *nomen dubium*); *Macrura reevesii*:Fowler, 1941:630, fig. 17 (China); Chu, Tchang & Chen, 1963:101, fig. 76 (China); *Hilsa reevesii*:Whitehead, 1965:139 (revision); *Idem*, 1966:30, pl. 2, fig. 3 (type of *reevesii*, the Reeves drawing); *Idem*, 1970:208 (type of *reevesii*, listed); *Tenualosa reevesii* - Wongratana, 1980:163, pl. 108, 109 (revision).

FAO Names : En - Reeves shad.



Diagnostic Features: Body moderately deep, compressed, belly with 31 to 32 scutes. Head large, its length 27 to 33% of standard length; a distinct median notch in upper jaw. Gillrakers fine and numerous, 80 to 250 on lower part of arch (increasing with size of fish), each raker with scattered asperities. Caudal fin moderate, 25 to 31% of standard length. A dark blotch behind gill opening and a series of spots along flanks. Resembles T. toli, which has a smaller head (25 to 27% of standard length), but longer caudal fin (31 to 34% of standard length) and only 60 to 75 gillrakers; T. macrura of Indonesia has a much longer tail (40 to 42% of standard length); T. thibaudeaui of Thailand has more gillrakers (more than 250 from 10 cm standard length). The notched upper jaw distinguishes it from other similar clupeids, except Hilsa kelee, which has numerous longitudinal striae on top of head.

Geographical Distribution: China (to about 30°N) and possibly southward into South China Sea, but records uncertain. Two specimens from eastern part of Indian Ocean (Phuket Island, Andaman Sea - see Wongratana, 1980:164). The species thus overlaps T. toli in range.



Habitat and Biology: Marine, pelagic and schooling in coastal waters, euryhaline, anadromous, ascending rivers to breed. More data needed.

Size: To at least 50 cm standard length.

Interest to Fisheries: Catches not reported, but probably of some importance in China.

Local Names: CHINA: Sam lai, San le.

Literature: There appear to be no recent studies.

Remarks: The Phuket Island specimens (Andaman Sea) suggest that T. reevesii continues the range eastward of the closely related T. ilisha (Indian Ocean only).

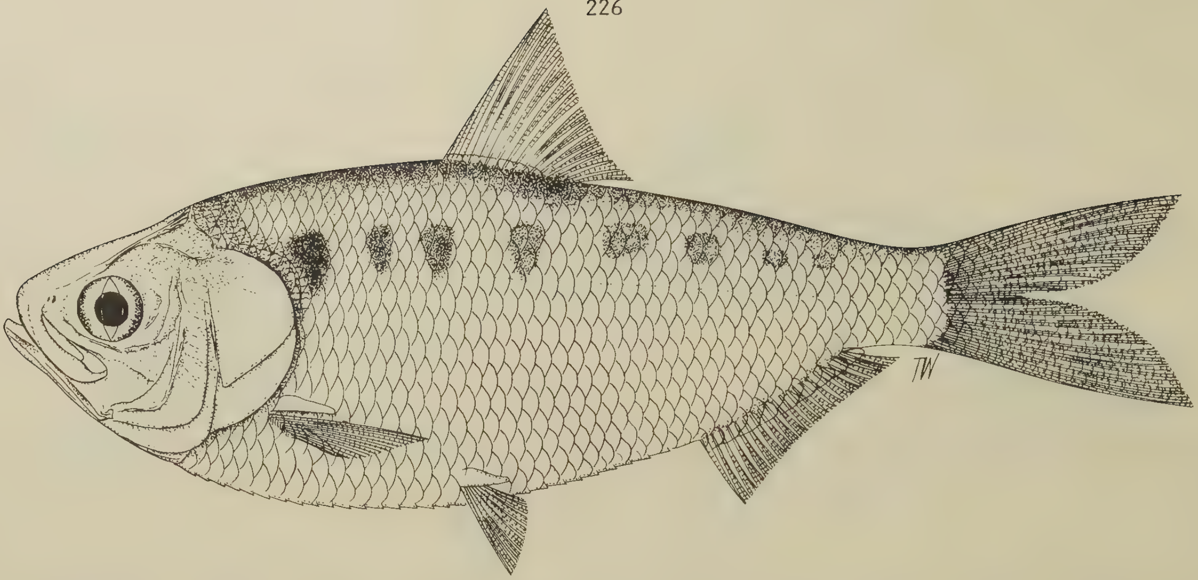
Tenualosa thibaudeaui (Durand, 1940)

CLUP Tenu 5

Clupea (Alosa) thibaudeaui Durand, 1940, Inst.océanogr.Indochine, (note 36):6, pl. 1 (Phnompenh).

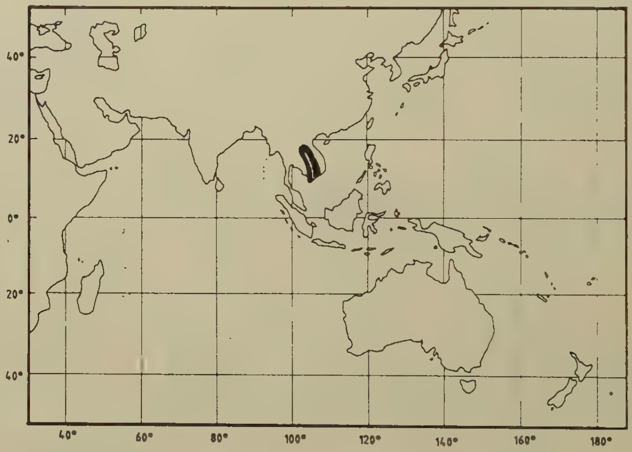
Synonyms: Hilsa kanagurta:Taki, 1974:47, fig. 48 (Laos - misidentified); Tenualosa thibaudeaui - Wongratana, 1980:166, pls 112, 113 (revision).

FAO Names: En - Laotian shad.



Diagnostic Features : Body moderately deep, compressed, belly with 28 to 30 scutes. Head large, its length 30 to 33% of standard length; a distinct median notch in upper jaw. Gillrakers fine and very numerous, 204 to 316 on lower part of arch (in fishes of 8.5 to 22 cm standard length, increasing with size of fish); with mucosal buds and not asperities on upper edges of rakers. Caudal fin moderate, about 25 to 30% of standard length. A dark blotch behind gill opening and a series of spots along flank. Closely resembles the Indian Ocean *T. ilisha*, which has fewer gillrakers (about 100 to 250) and *T. reevesii* (probably present in South China Sea), which also has fewer gillrakers (about 80 to 250); the gillrakers increase with size of fish, but even at 10 cm standard length *T. thibaudeaui* has more than 250 rakers. The notched upper jaw and spots along flank distinguish it from any similar clupeids where it occurs, except *Hilsa kelee*, which has numerous longitudinal striae on top of head.

Geographical Distribution : Mekong River system (at Nongkai and at Ubon-rajthani on Mool River, Thailand; also Luang Prabang, Vientiane, Pakse, Hatsalao, Tha Ngon and Tha Bo, Laos; these localities are up to nearly 2000 km from the sea, e.g. Luang Prabang at about 20°N).



Habitat and Biology : Riverine (at least judging from the distance up the Mekong River). A ripe male of 12.7 cm was recorded at Nongkai, Thailand (Wongratana, 1980:167). More data needed.

Size : To 26 cm standard length (*fide* Durand, 1940 - specimens lost; a fish of 21.7 cm examined by Wongratana).

Interest to Fisheries : Perhaps of local interest.

Local Names : LAOS: Pa mak pang.

Literature : See synonymy.

Remarks : If truly confined to freshwaters, then resembles the populations of *T. ilisha* in the upper parts of the Ganges, which are believed not to migrate back to the sea.

Tenualosa toli (Valenciennes, 1847)

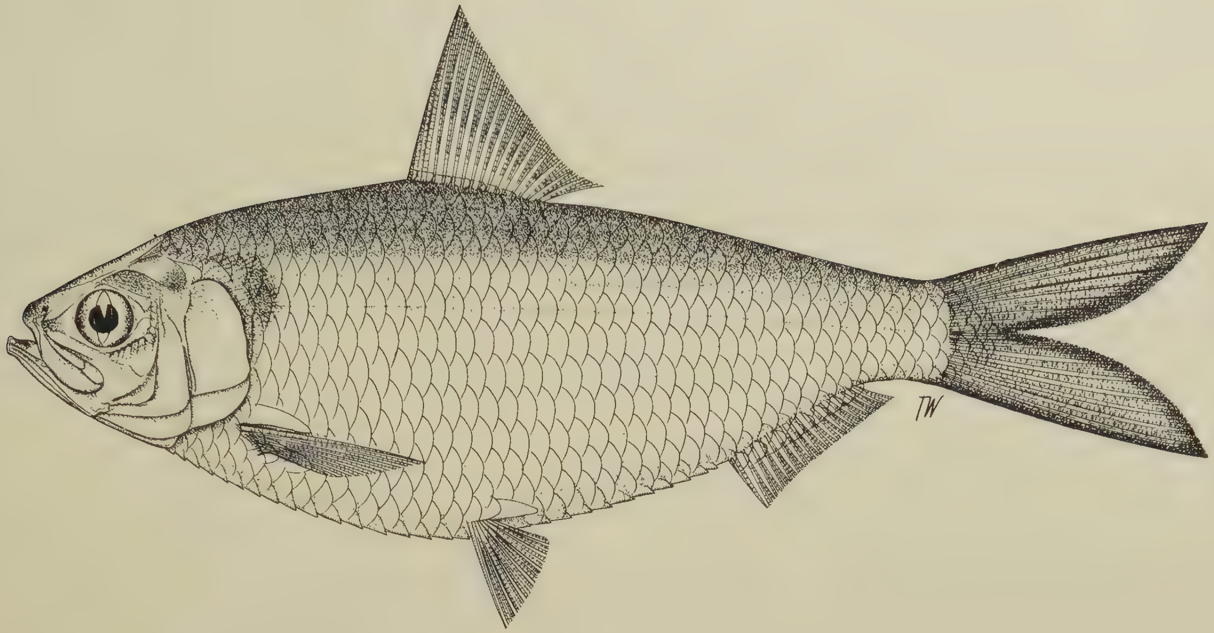
CLUP Tenu 2

Formerly CLUP Hils 4

Alausa toli Valenciennes, 1847, *Hist.nat.poiss.*, **20**:435 (Bombay, Pondicherry).

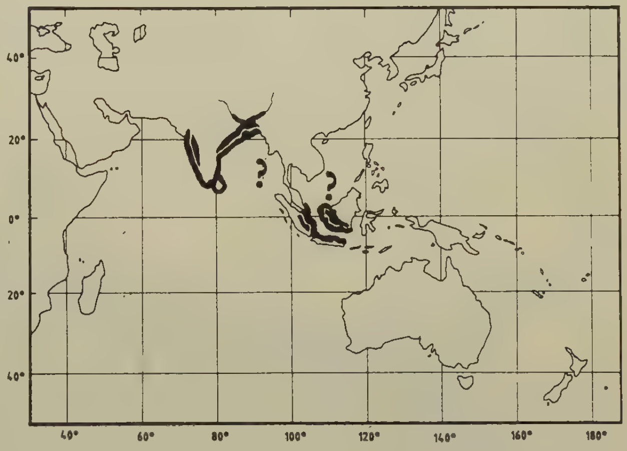
Synonyms : *Alausa argyrochloris* Valenciennes, 1847:440 (Bombay, but not Mauritius specimens); *Alausa ctenolepis* Bleeker, 1852:74 (Jakarta, Muntok, Singapore); *Macrura sinensis*:Fowler, 1941:631 (compiled, the name *sinensis* considered to derive from *Clupea sinensis* Linnaeus, 1758:319, but that species probably composite; Fowler's China references will be *T. reevesii*, or for Thailand perhaps *T. thibaudeaui*); *Hilsa toli*:Whitehead, 1965:143, fig. 10 (revision); Whitehead *et al.*, 1966:85 (type of *ctenolepis*); Whitehead, 1967:93 (types of *toli*, *argyrochloris*); Whitehead, 1973b:200, fig. 28 (key, synonymy, refs); *Tenualosa toli* - Wongratana, 1980:161, pls 104, 105 (revision); Whitehead & Bauchot, in press (types of *toli*, *argyrochloris*).

FAO Names : En - Toli shad.



Diagnostic Features : Body moderately deep, compressed, belly with 28 to 30 scutes. Head length 25 to 27% of standard length; a distinct median notch in upper jaw. Gillrakers fine but not numerous, 60 to 100 on lower part of arch (barely increasing after 10 cm standard length). Caudal fin short, 31 to 34% standard length. At most, a dark diffuse mark behind gill opening, but no other spots on flank. Resembles *T. ilisha*, which has a longer head (28 to 32% standard length), shorter caudal fin (25 to 31% standard length), more gillrakers (100 to 250, increasing in larger fishes) and spots along the flank, also scutes 30 to 33. Other *Tenualosa* species also have more than 100 gillrakers in fishes over about 10 cm standard length. The notched upper jaw distinguishes it from other similar clupeids, except *Hilsa kelee*, which has numerous longitudinal striae on top of head and spots along flank. See CLUP Tenu 2, Fishing Area 51; also CLUP Hils 4, Fishing Areas 57, 71.

Geographical Distribution : India (eastern and western coasts, also rivers) to Java Sea and South China Sea (Java, Thailand, thus overlapping range of *T. macrura*).



Habitat and Biology : Marine, pelagic and schooling in coastal waters, euryhaline and perhaps anadromous, ascending rivers to breed (but in some areas fishery workers claim that it does not). Presumably its biology is similar to that of *T. ilisha*, but the fewer gillrakers suggest that it takes larger food organisms. More data needed, especially since it is not always distinguished from *T. ilisha*, especially at juvenile stages.

Size : To 50 cm standard length.

Interest to Fisheries : Not always distinguished from *T. ilisha* in catches. Caught with the same gear as *T. ilisha* (gillnets, seines, etc.).

Local Names : INDIA: Chandan-ilish (Calcutta), Kajli-ilish.

Literature : As given in synonymy.

Gudusia Fowler, 1911

GLUP Gud

Gudusia Fowler, 1911, *Proc.Acad.nat.Sci.Philad*:207 (type: *Clupanodon chapra* Hamilton-Buchanan). Given incorrectly by some authors as *Gadusia*.

Diagnostic Features: Moderate-sized herring-like fishes (to about 16 cm standard length), body quite deep and compressed, with a keel of scutes along belly. Snout shorter than eye; upper jaw with a distinct median notch. Gillrakers fine and numerous, increasing with size of fish (100 to 280 in specimens of 4 to 16 cm standard length). Pelvic finrays i 7, its insertion usually just before dorsal fin origin; anal fin short, well behind dorsal fin base. Scales small, the rows somewhat irregular except on upper part of body, 77 to 91 in lateral series. Resembles *Tenualosa*, which has fewer scales (37 to 47), evenly arranged, and the snout usually longer than eye. Gizzard shads have an inferior mouth and most have a filamentous last dorsal finray. Other clupeids have no notch in the upper jaw.

Biology, Habitat and Distribution: Riverine shads of India to Burma.

Interest to Fisheries: Contribute to artisanal fisheries in rivers.

Species: According to Wongratana (1980) only 2 species:

G. chapra (Hamilton-Buchanan, 1822), Indian rivers
G. variegata (Day, 1869), Burmese rivers.

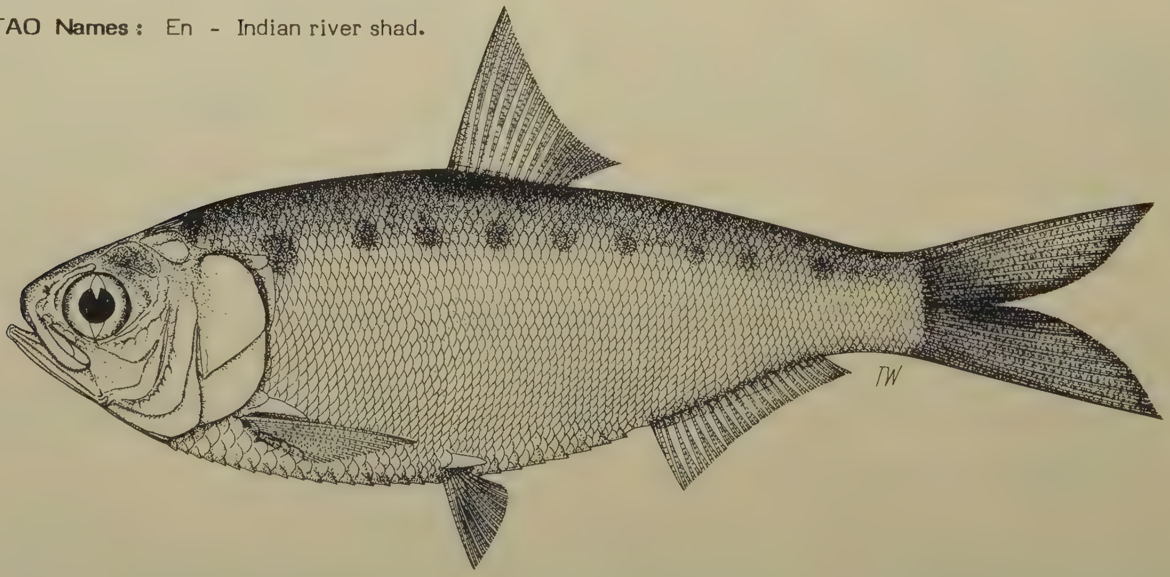
Gudusia chapra (Hamilton-Buchanan, 1822)

CLUP Gud 1

Clupanodon chapra Hamilton-Buchanan, 1822, *Fishes of Ganges*:248, 383 (upper Ganges).

Synonyms: *Clupanodon cagius* Hamilton-Buchanan, 1822:250, 383 (Ganges in northern Bihar); *Clupea indica* Gray, 1834:pl. 91, figs 1, 2 (India, on Hardwicke drawing); *Clupea champil* Gray, 1834:pl. 91, figs 5, 6 (India, on Hardwicke drawing); *Alausa microlepis* Valenciennes, 1847:439 (Bengal); *Clupea suhia* Chaudhuri, 1912:436, pl. 38, fig. 1 (Gandak River at Saran, Bihar); *Gudusia godanahiai* Srivastava, 1968:6, fig. 4a, b (Gorakhpur, Uttar Pradesh); *Gudusia chapra* - Fowler, 1941:634 (Ganges); Whitehead, 1965:148, fig. 11 (revision); *Idem*, 1967:95 (types of *microlepis*); Idem, 1973b:201, fig. 29 (key, synonymy, refs); Wongratana, 1980:167, pls 114, 115 (revision); Jayaram, 1981:40, fig. 25 (key only).

FAO Names: En - Indian river shad.



Diagnostic Features: Body fairly deep, its depth 31 to 39% of standard length; 26 to 29 scutes along belly. A single triangular pectoral axillary scale; depressed tip of dorsal fin to behind vertical from anal fin origin. Hind margin of scales smooth. Dark blotch behind gill opening, often followed by a series of spots along flank. Resembles *G. variegata* of Burmese rivers, which is much deeper (depth 42 or 43% of standard length), has more scutes (29 or 30), the depressed dorsal fin tip not reaching vertical from anal fin origin, and the hind margin of the scales toothed. Species of *Tenualosa* have larger scales (only 37 to 47 in lateral series; cf. 77 to 91).

Geographical Distribution : Rivers of India and Bangladesh affluent to the Bay of Bengal (chiefly the Ganges and Brahmaputra systems and the Mahanadi River of Orissa).

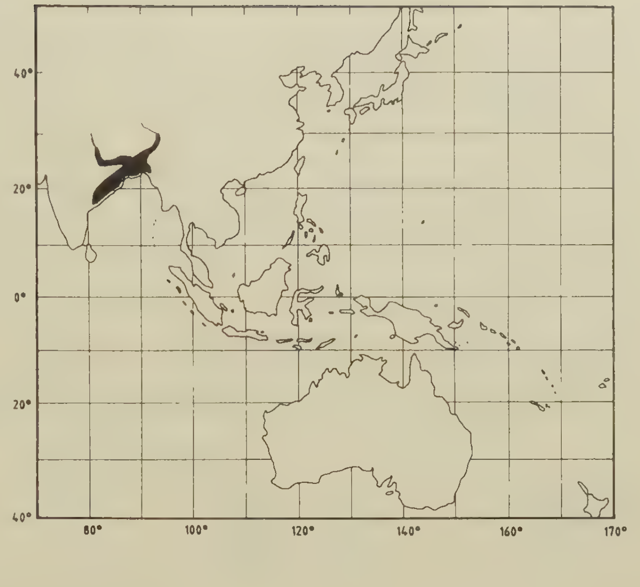
Habitat and Biology : Riverine in middle and upper reaches. More data needed.

Size : To 15 cm standard length.

Interest to Fisheries : Contributes to riverine artisanal fishes, but catches not recorded.

Local Names : -

Literature : Whitehead (1973b - reference to 5 papers that include notes on biology).



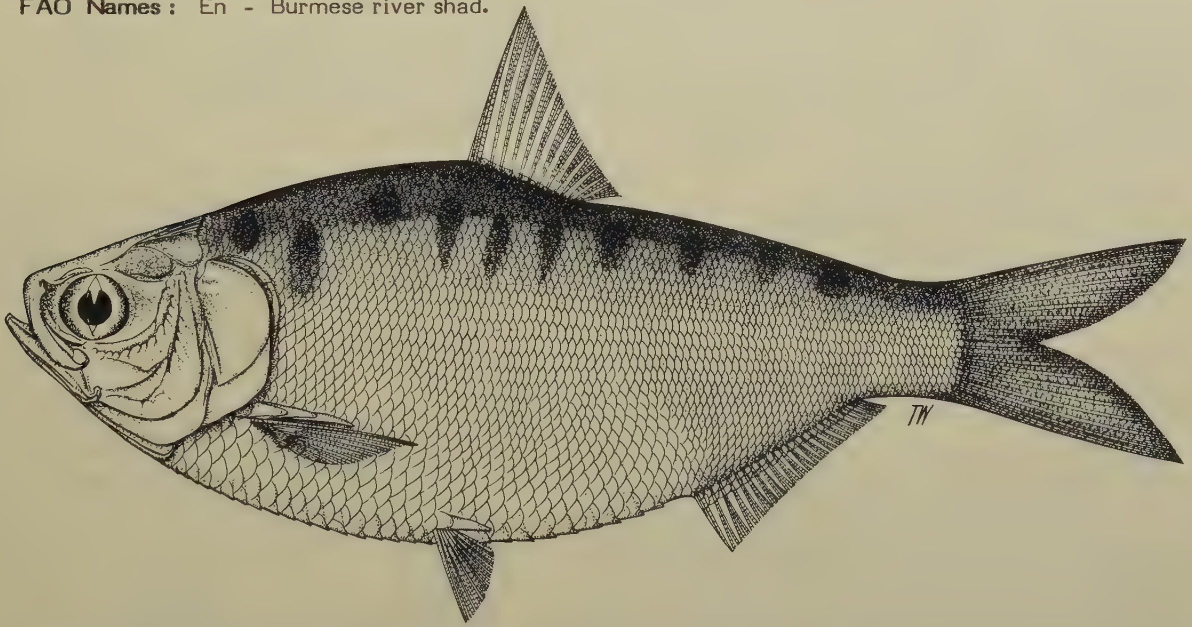
Gudusia variegata (Day, 1869)

CLUP Gud 2

Clupea variegata Day, 1869, Proc.zool.Soc.Lond.:623 (Irrawady River, Burma).

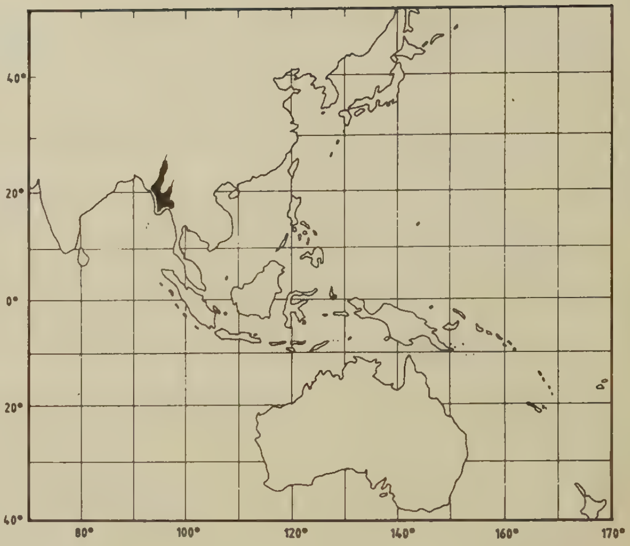
Synonyms : Gudusia variegata - Fowler, 1941:635 (on Day); Whitehead, 1965:150, fig. 12 (revision); Idem, 1973b:201 (in key only); Wongratana, 1980:169, pls 116, 117 (revision); Jayaram, 1981:40 (key only).

FAO Names : En - Burmese river shad.



Diagnostic Features : Body deep, its depth 42 or 43% of standard length; 29 or 30 scutes along belly. Three small triangular pectoral axillary scales; depressed tip of dorsal fin not reaching to vertical from anal fin origin. Hind margin of scales toothed. Dark blotch behind gill opening, followed by a series of spots along upper flank. Resembles G. chapra of Indian rivers, which is more slender (depth 31 to 39% of standard length), has fewer scutes (26 to 29), the depressed dorsal fin tip surpassing the anal fin origin, and the hind border of the scales smooth. Species of Tenualosa have larger scales (only 37 to 47 in lateral series; cf. 77 to 91).

Geographical Distribution : Rivers of Burma (chiefly the Irrawaddy, but perhaps others).



Habitat and Biology : Riverine in middle and upper reaches. More data needed.

Size : To about 16 cm standard length.

Interest to Fisheries : Contributes to riverine artisanal fisheries, but catches not recorded.

Local Names : -

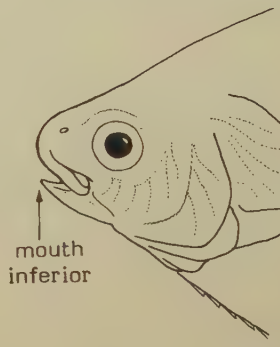
Literature : See under synonyms.

Remarks : Rather few specimens seem to have been studied (Wongratana, 1980, saw only three).

2.2.5 SUBFAMILY DOROSOMATINAE

FAO Names : En - Gizzard shads.

Diagnostic Features : Moderate-sized herring-like fishes (to about 30 cm standard length or a little more); fully scuted along belly, scutes also present on back before dorsal fin in some (Clupanodon). Mouth inferior or subterminal, sometimes terminal, snout usually projecting; upper jaw not evenly rounded in front, but with a distinct median notch into which the symphysis of the lower jaw fits; no teeth. Gillrakers fine and numerous; a pair of pharyngeal pouches above 4th gill arch, apparently for collecting food seived by gillrakers. Dorsal fin at about midpoint of body, last dorsal finray filamentous and long (except in the Indo-Pacific Gonialosa and Anodontostoma); anal fin moderate, up to 38 finrays; pelvic fin under or a little before dorsal fin origin, with i 7 finrays. Scales usually well attached, usually 38 to 55 in lateral series (but 43 to 71 scales in Gonialosa and up to 86 in some Dorosoma). Stomach muscular, gizzard-like. A dark spot often present behind gill opening, in some species followed by a series of spots.

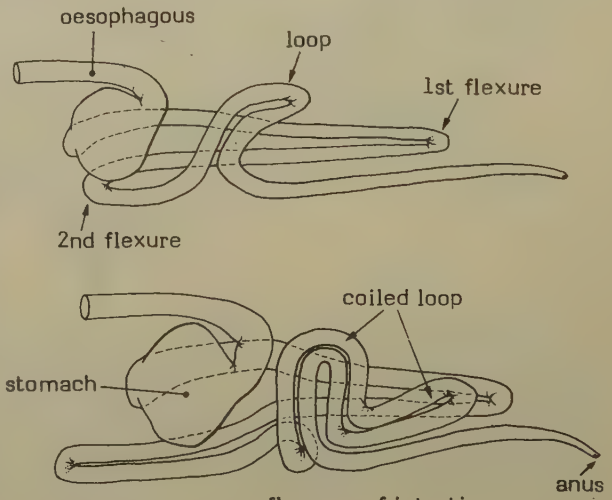


Biology, Habitat and Distribution : The Dorosomatinae are either marine, pelagic and apparently anadromous, or estuarine or purely fluviatile, but more data is needed to show whether all species spawn in freshwater. Food, together with mud and other material grubbed from the bottom, is filtered by the gillrakers and believed to be concentrated in the pharyngeal pouches, thereafter being everted as a bolus and passed down the pharynx to the muscular stomach.

Interest to Fisheries : Gizzard shads contribute rather little to fisheries (perhaps about 10 000 tons a year), but may be locally important.

Remarks : Separation of the gizzard shads from the shads (subfamily Alosinae) may be artificial; a gizzard is found in the shads Brevoortia and Ethmidium, and a more or less muscular stomach occurs in Hilsa, Gudusia and Ethmalosa (as well as in the clupeine Opisthonema). Nevertheless, only the gizzard shads have a unique feature: the intestine is doubled into a characteristic loop (the so-called 'third primary flexure'), either a simple loop, or a loop that is coiled or doubled-back on itself (Nelson & Rothman, 1973).

There are 5 genera (1 Atlantic coasts and drainage of North and central America, 4 Indo-West Pacific coasts and drainage) and about 22 species, the largest genus being Nematalosa (9 species, but more to be described).



flexures of intestine

Key to the Genera

1a. New World only; anterior (first) supramaxilla present (but thin and scale-like); last dorsal finray produced, filamentous (Fig. 1) .... **Dorosoma**

1b. Indo-Pacific only; no anterior supramaxilla

  2a. Last dorsal finray produced, filamentous

    3a. Gillrakers of first arch at least 3/4 length of corresponding gill filaments; mouth subterminal, upper jaw straight (Fig. 2a); pre-dorsal scales paired, but not overlapping in midline (Fig. 3a)

      4a. Post-pelvic scutes 11 or 12; dorsal scutes present .... **Clupanodon**

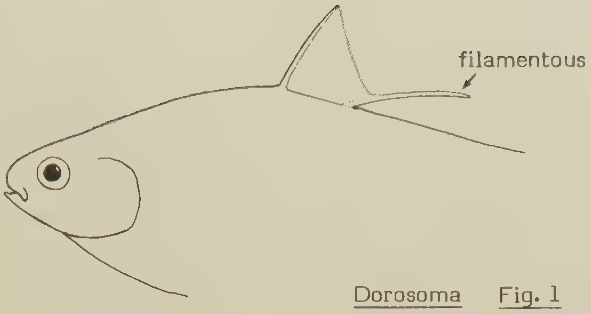
      4b. Post-pelvic scutes 14 to 16; no dorsal scutes .. **Konosirus**

    3b. Gillrakers of first arch not more than half length of corresponding gill filaments; mouth inferior, upper jaw curved downward (Fig. 2b); pre-dorsal scales paired and overlapping in midline (Fig. 3b) .... **Nematalosa**

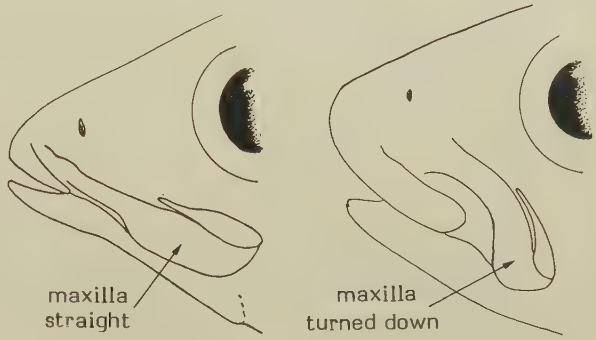
  2b. Last dorsal finrays normal, not filamentous

    5a. A median series of pre-dorsal scales (Fig. 4); 38 to 45 scales in lateral series (usually 40 to 43); marine ...... **Anodontostoma**

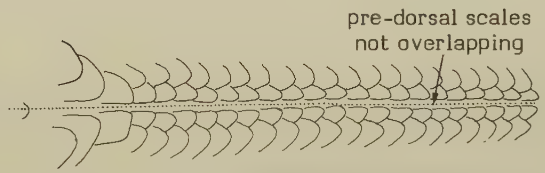
    5b. Paired pre-dorsal scales, overlapping in midline; 43 to 71 scales in lateral series; freshwater, rivers affluent to Bay of Bengal .... **Gonialosa**


filamentous

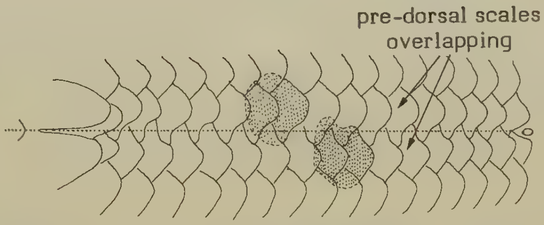
Dorosoma Fig. 1


maxilla
straight
maxilla
turned down

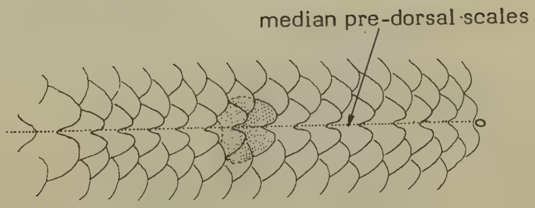
a. Clupanodon b. Nematalosa Fig. 2


pre-dorsal scales
not overlapping

a. Clupanodon, Konosirus


pre-dorsal scales
overlapping

b. Nematalosa Fig. 3


median pre-dorsal scales

Anodontostoma Fig. 4

Dorosoma Rafinesque, 1820

CLUP Doros

Dorosoma Rafinesque, 1820, Western Review & Misc.Mag., **2**(3, April):171 (see Fowler, 1945:6, 8) (type: Dorosoma notata Rafinesque = Megalops cepediana LeSueur). Chatoessus Cuvier, 1829, Règne animal, 2nd ed., **2**:320 (in part; restricted to Megalops cepediana by Valenciennes, 1847). Signalosa Evermann & Kendall, 1898, Bull.U.S.Fish Commn, **17**:127 (type: Signalosa atchafalayae = Meletta petenesis Günther).

Diagnostic Features : Medium-sized gizzard shads (to 35 cm standard length, usually to about 20 to 25 cm), the body compressed and moderately deep in some. Snout projecting, rounded, mouth small, terminal or inferior; upper jaw with a thin, scale-like anterior (first) supra-maxilla, lower jaw included when mouth closed. Gillrakers fine and numerous. Last dorsal finray filamentous (except in young); anal fin comparatively long, with 17 to 38 finrays, its origin below or just behind base of last dorsal finray. Scales moderate (less than 50 in lateral series) and regular, or numerous (more than 50) and somewhat irregular. A dark spot behind gill opening in most specimens.

Biology, Habitat and Distribution : Coastal saltwater and brackishwater to freshwater, the latter either for spawning or as a permanent habitat. All species are filterfeeders. Found associated with the Atlantic drainage of North and central America and the Pacific drainage of central America.

Interest to Fisheries : Of limited local interest.

Species : Miller (1960) recognized five species in two subgenera, accepted by Nelson & Rothman (1973):

Subgenus Dorosoma (mouth inferior; scales more than 50)

D. anale Meek, 1904, drainage of western Gulf of Mexico
D. cepedianum (LeSueur, 1818), Atlantic and Gulf drainage of North and central America
D. chavesi Meek, 1907, Nicaraguan lakes
D. smithi Hubbs & Miller, 1941, Pacific drainage of Mexico.

Subgenus Signalosa (mouth terminal; scales less than 50)

D. petenense (Günther, 1866), Atlantic and Gulf drainage of North and central America.

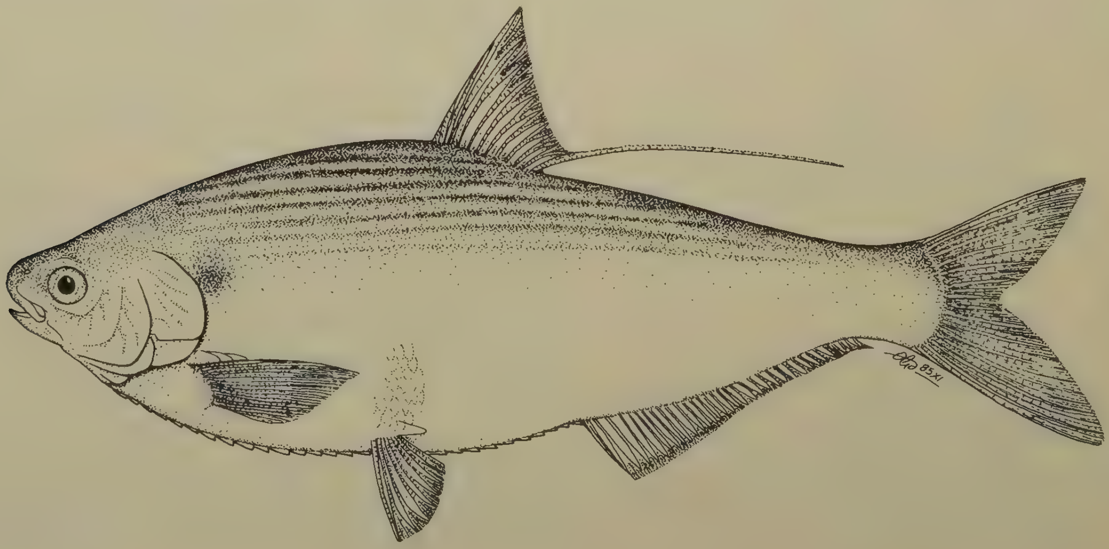
Dorosoma anale Meek, 1904

CLUP Doros 2

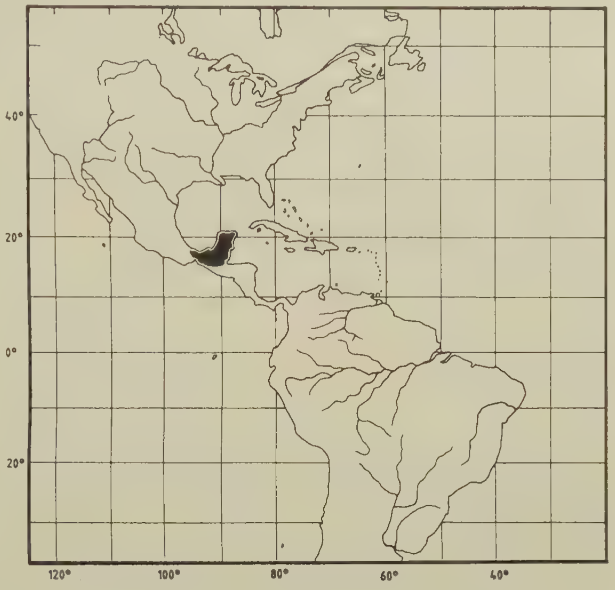
Dorosoma anale Meek, 1904, Publs Field Mus., (93)(zool.Ser.), **5**:93, fig. 26 (El Hule = Río Papaloapán, Mexico).

Synonyms : Dorosoma anale - Miller, 1950:395 (revision); Idem, 1960:373 (key only); Nelson & Rothman, 1973:170, pl. 11B (photo) (bibliography).

FAO Names : En - Mexican river gizzard shad.



Diagnostic Features: Body moderately deep, its depth 34 to 40% of standard length, belly with 18 + 10 or 11 scutes. Mouth small, inferior; lower jaw short, about 8 to 10% of standard length. Last dorsal finray long, about equal to distance snout tip to about mid-pectoral fin; anal fin long, with 29 to 38 finrays. Scales small, somewhat irregular, 70 to 82 in lateral series. A dark spot behind gill opening. Resembles D. cepedianum, whose southward range it continues, but that species has fewer scales (52 to 70, usually 58 to 65) and a shorter anal fin base (equals anal fin origin to hind third of pectoral fin; cf. to front third in D. anale); D. petenense has fewer scales (41 to 48). Species of Opisthonema also have a filamentous last dorsal finray and dark spot behind gill opening, but anal fin short and well behind dorsal fin base. Other clupeids lack dorsal filament.



Geographical Distribution: Mexico (Río Papaloapan in southern Veracruz and Oaxaca) southward to northern Guatemala (Río Ucumacinta basin).

Habitat and Biology: Riverine, apparently not yet recorded in brackishwater. More data needed.

Size: To about 20 cm standard length.

Interest to Fisheries: Perhaps of small local interest.

Local Names: -

Literature: Only six references found by Nelson & Rothman (1973), none dealing with the biology of the species.

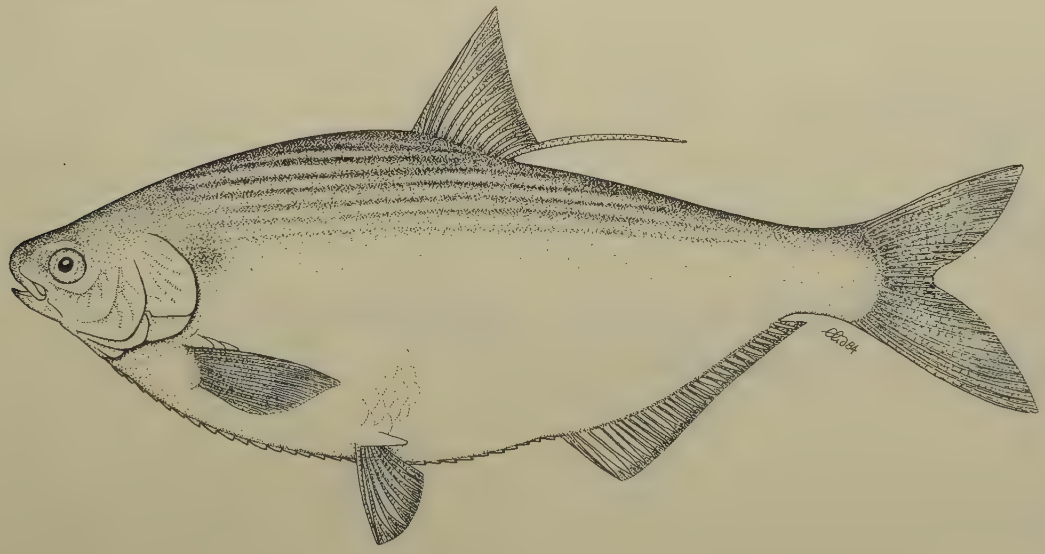
Dorosoma cepedianum (LeSueur, 1818)

CLUP Doros 1

Megalops cepediana LeSueur, 1818, J.Acad.nat.Sci.Philad., **1**:361 ('Philadelphia' = residence of LeSueur; exact locality not known, presumably Chesapeake and Delaware Bays).

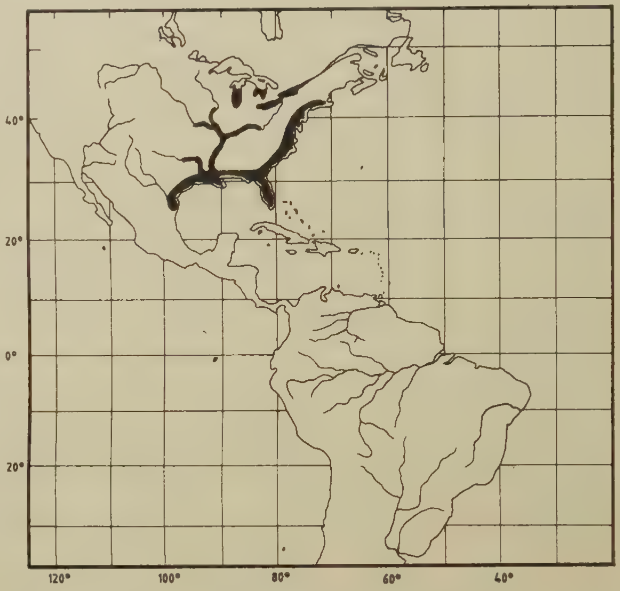
Synonyms: Clupea heterura Rafinesque, 1818:354 (Ohio River); Dorosoma notata Rafinesque, 1820:172 (falls of Ohio River); Chatoessus ellipticus Kirtland, 1838:169, 195 (nomen nudum); Megalops bimaculata Valenciennes, 1847:104 (nomen nudum, in synonymy of cepedianus); Chatoessus insociabilis Abbott, 1861:365 (pond 2 miles below Trenton, New Jersey); Dorosoma cepedianum exile Jordan & Gilbert, 1883:585 (Galveston Bay, Texas); Dorosoma lacepedi Berry, 1958:318 (age and growth); Dorosoma cepedianum - Miller, 1950:392 (revision); Idem, 1960:373, fig. 1, also 2-4 (embryos, larvae) (revision); FWNA, 1964:444, fig. 116 (review); Nelson & Rothman, 1973:170, pl. 11c (photo) (bibliography from 1960, rather complete); Whitehead & Bauchot, in press (types of cepediana, status of bimaculata).

FAO Names: En - American gizzard shad.



Diagnostic Features : Body moderately deep, its depth about 30 to 40% of standard length, belly with 17 to 20 - 10 to 14 scutes. Mouth small, inferior; lower jaw short, about 9 to 12% of standard length. Last dorsal finray long, about equal to distance from snout tip to mid-pectoral fin or beyond; anal fin long, with 25 to 36 finrays. Scales small, somewhat irregular, 52 to 70 in lateral series (usually 58 to 65). A dark spot behind gill opening. Resembles D. anale, which continues its southward range, but that species has more scales (70 to 82) and a longer anal fin base (equals anal fin origin to front third of pectoral fin; cf. to hind third in D. cepedianum); D. petenense has fewer scales (41 to 48). Species of Opisthonema also have a filamentous last dorsal finray and dark spot behind gill opening, but anal fin not longer than head and well behind dorsal fin base. Other clupeids lack dorsal filament. See CLUP Doros 1, Fishing Area 31.

Geographical Distribution : Atlantic and Gulf of Mexico drainage of North and central America (southeastern South Dakota and central Minnesota, the Great Lakes drainage, i.e. in Lake Erie, southern parts of Lakes Huron and Michigan, Lake Ontario basin; not Lake Superior; extreme southern New York southward to the Mississippi system and smaller rivers affluent to the Gulf southward to the Río Pánuco, Mexico.



Habitat and Biology : Mainly in freshwater in large rivers, reservoirs, lakes, swamps, temporary floodwater pools, etc., but adults also found in brackish or saline water of estuaries or bays, preferring quieter open waters. Filter-feeding, almost entirely herbivorous; the food is strained by the numerous fine gillrakers, then presumably transferred in a mucus stream to the pharyngeal pouches, concentrated and in some way everted as a bolus into the pharynx. Breeds near surface in freshwater from late winter (mid-March) through most of the summer (at least to about mid-August) in ponds, lakes and large rivers; eggs adhesive and sink (embryonic and larval development figured and described by Miller, 1960).

Size : To about 35 cm standard length (20.5 inches total length recorded), usually about 20 cm.

Interest to Fisheries : Small catches only recorded (in 1983 a total catch of only 461 tons). It is valued as a forage for various game fishes and has been used to some exent for fertilizer or cattle food.

Local Names : USA: Eastern gizzard shad, Gizzard shad (AFS list), Hickory shad, Mud shad, Skipjack.

Literature : Miller (1960 - excellent review of taxonomy and biology); Nelson & Rothman (1973 - literature from 1960, 158 references).

Remarks : Hybrids between this species and D. petenense were reported in the Ohio River by Minckley & Krumholz (1960). The two species overlap over much of their ranges and frequently occur together.

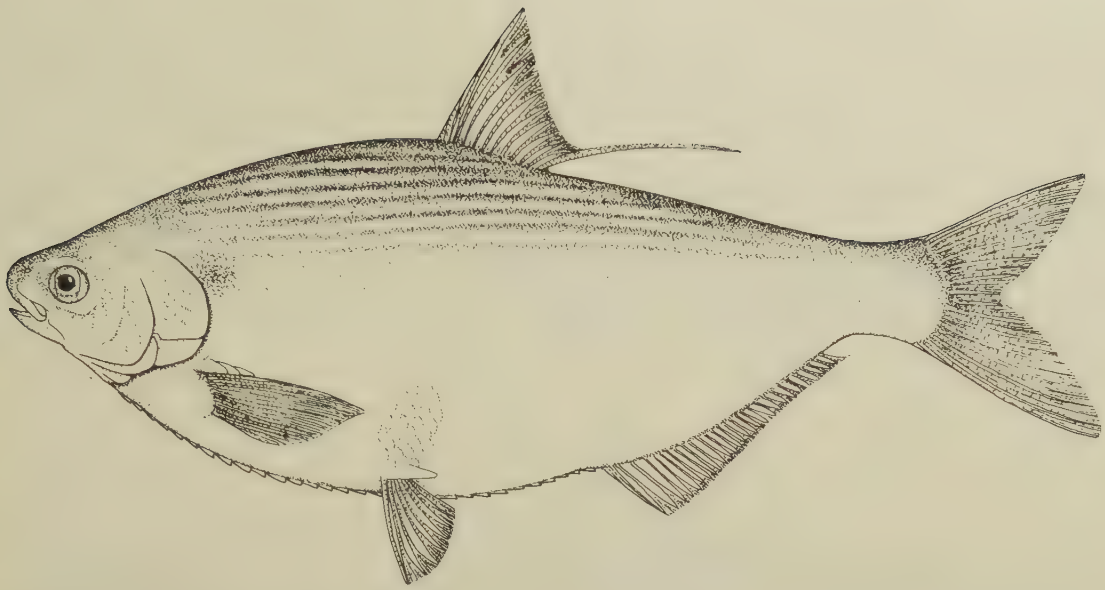
Dorosoma chavesi Meek, 1907

CLUP Doros 3

Dorosoma chavesi Meek, 1907, Publs Field Mus.(121)(zool.Ser.), **7**:112 (Laguna Jenícero, between Lakes Managua and Nicaragua).

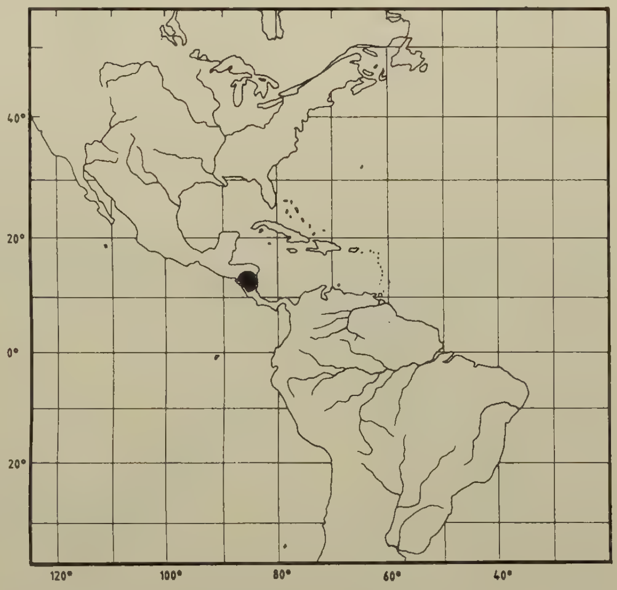
Synonyms : Dorosoma chavesi - Miller, 1950:398 (revision); Idem, 1960:373 (key only); Astorqui, 1971:29, fig. 8 (descr., Lakes Managua and Nicaragua); Nelson & Rothman, 1973:172, fig. 12A (photo) (bibliography).

FAO Names : En - Nicaragua gizzard shad.



Diagnostic Features : Body moderately deep, its depth about 34 to 40% of standard length, belly with 15 to 18 + 9 to 12 scutes. Mouth relatively large, inferior or subterminal; lower jaw comparatively long, about 11 to 16% of standard length, upper jaw reaching to vertical from eye centre. Last dorsal finray long, but less than distance from snout tip to pelvic fin base; anal fin moderately long, with 24 to 30 finrays. Scales small, somewhat irregular, 72 to 86 in lateral series. A dark spot behind gill opening. No other Dorosoma species found so far south (D. anale of northern Guatemala and southern Mexico has 29 to 38 anal finrays; D. smithi of the Pacific drainage of central America a smaller mouth). No other clupeid in the area resembles D. chavesi; Tarpon atlanticus has a dorsal filament, but lacks scutes, lower jaw projects, scales less than 50.

Geographical Distribution : Nicaragua (lakes Managua and Nicaragua and affluent streams or rivers).



Habitat and Biology : Riverine and lacustrine. More data needed, but presumably feeding and breeding similar to other Dorosoma species.

Size : To 18 cm standard length.

Interest to Fisheries : Perhaps of small local importance.

Local Names : -

Literature : Miller (1950 - revision); Astorqui (1971 - descr.).

Remarks : Miller (1950) found differences between his specimens from Lake Managua and Lake Nicaragua and suspected that the falls between these lakes served to isolate the Managua population. Astorqui (1971) confirmed many of Miller's differences, in particular:

Lake Managua: head length 32.6 to 35.5%, anal fin base 24.6 to 27.1%, pre-pelvic distance 49.2 to 53% of standard length

Lake Nicaragua: head length 29.2 to 32.3%, anal fin base 27.6 to 29.6%, pre-pelvic distance 43.7 to 49.5% of standard length.

However, neither author proposed a subspecies.

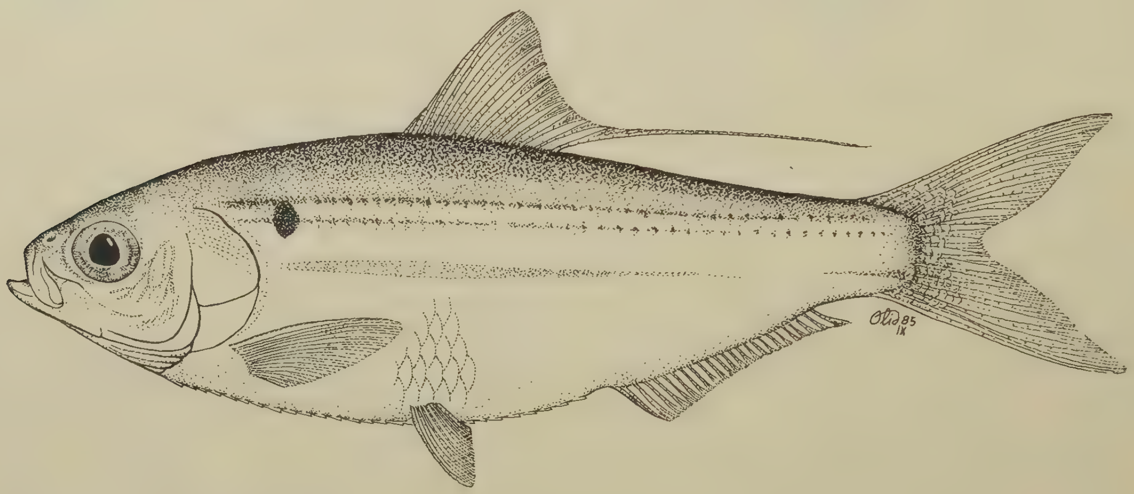
Dorosoma petenense (Günther, 1866)

CLUP Doros 5

Meletta petenensis Günther, 1866, Proc.zool.Soc.Lond., (3):603 (Lake Petén, Guatemala) (emended to petenense by Jordan & Evermann, 1896:417).

Synonyms : Chatoessus mexicanus Günther, 1868:409 (Mexico, New Orleans, Louisiana); Signalosa atchafalayae Evermann & Kendall, 1898:127, pl. 7, fig. 4 (Atchafalaya River at Melville, Louisiana; also Mississippi); Signalosa mexicana campi Weed, 1925:143 (Resaca de la Guerra, on or near Media Luna Ranch, Brownsville, Texas); Signalosa atchafalayae vanhyningi Weed, 1925:145 (Prairie Creek, 6 miles southeast of Gainsville, Florida); Dorosoma petenense - Miller, 1960:373 (key only); FWNA, 1964:448, fig. 117 (review); Nelson & Rothman, 1973:173, pl. 12C (photo) (bibliography from 1960, rather complete).

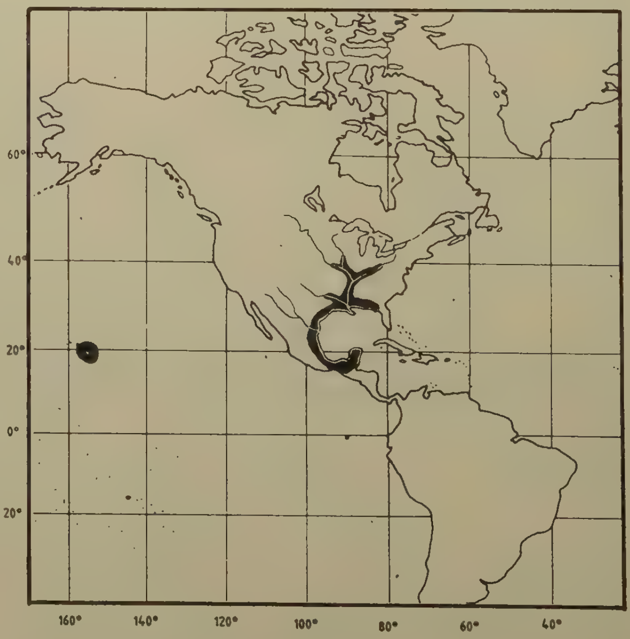
FAO Names : En - Threadfin shad.



Diagnostic Features : Body moderately deep, its depth about 30 to 40% of standard length, belly with 15 to 18 + 8 to 12 scutes. Mouth small, terminal. Last dorsal finray long, about equal to distance from snout tip to mid-pectoral fin or beyond; anal fin relatively short, with 17 to 27 finrays. Scales relatively large, regularly arranged, 41 to 48 in lateral series. A dark spot behind gill opening. Distinguished from D. cepedianum and other related species by the larger scales (more than 50 in other Dorosoma species, somewhat irregularly arranged) and terminal mouth (cf. inferior or at most subterminal in D. chavesi of Nicaragua). Species of Opisthonema also have a filamentous last dorsal finray and dark spot behind gill opening, but anal fin not longer than head and well behind dorsal fin base. Other clupeids lack dorsal filament.

Geographical Distribution : Gulf of Mexico drainage of North and central America (Mississippi system, from the Ohio River of Kentucky and southern Indiana southwestward to Oklahoma, and south to Texas and Florida, also rivers around the Gulf to northern Guatemala; also Belize River, British Honduras). Invasion of the Ohio River basin appears to have been relatively recent; the species has been planted in Virginia, West Virginia, Georgia, Pennsylvania, Kansas, Arizona, Nevada, California and New Mexico (Minckley & Krumholz, 1960), and introduced in 1958 into Hawaiian waters (Oahu, Kauai, Maui) (Brock, 1960).

Habitat and Biology : Pelagic, often schooling, mainly in freshwater in large rivers, reservoirs, lakes, swamps, temporary floodwater pools, etc., but adults also found in brackish or saline water of estuaries and bays (up to 30°/oo salinity; juveniles to about 15°/oo). Filter-feeding, but not entirely herbivorous since copepods, cladocerans and even fish fry have been recorded; method of feeding presumably similar to that of D. cepedianum. Breeds in spring and again in autumn, in open waters near or over plants or other objects; eggs slightly adhesive.



Size : To 18 cm standard length in southern part of range, but only about 10 to 12 cm in northern part.

Interest to Fisheries : Valued as a food for larger game fishes, hence its introduction into other waters; also as a potential live bait (e.g. for tuna in Hawaii).

Local Names : -

Literature : Minckley & Krumholz (1960 - distribution, hybrids); Miller (i.e. FWNA, 1964 - review); Nelson & Rothman (1973 - literature from 1960, 103 references).

Remarks : Miller (1960, 1964) considered Signalosa as merely a subgenus of Dorosoma; Minckley & Krumholz (1960) gave it generic status. Nelson & Rothman (1973), the latest reviewers, favoured subgeneric status and are followed here. For hybridization with D. cepedianum, see that species.

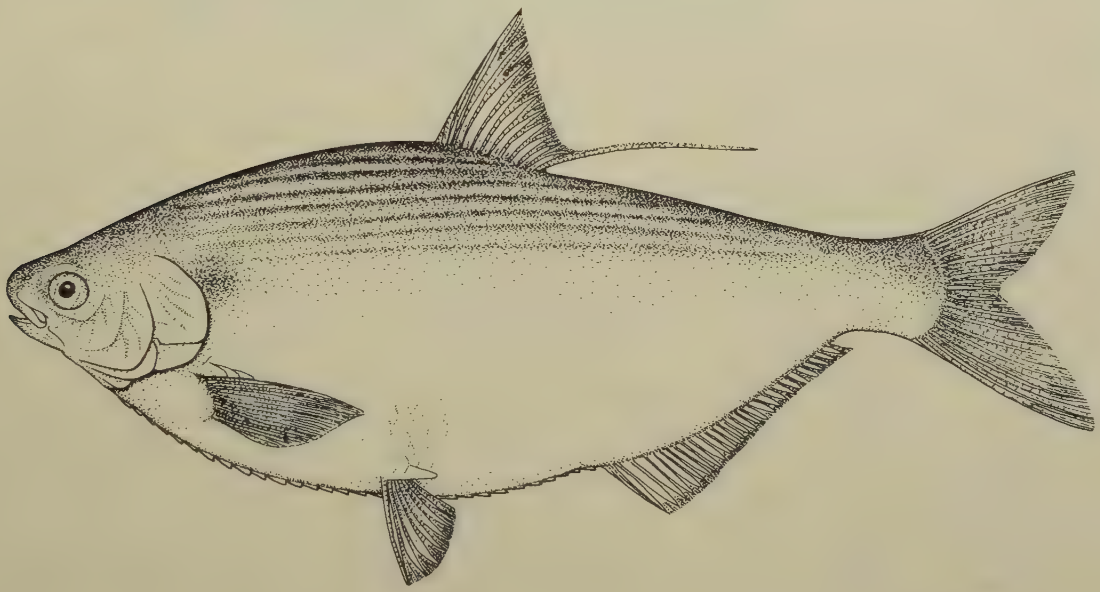
Dorosoma smithi Hubbs & Miller, 1941

CLUP Doros 4

Dorosoma smithi Hubbs & Miller, 1941, Copeia, (4):232, fig. 1 (Río Piaxtla near Piaxtla, Sinaloa, Mexico).

Synonyms : Dorosoma smithi - Miller, 1950:401 (revision); Idem, 1960:373 (key only); Branson, McCoye & Sisk, 1960:218 (Sonora, Mexico); Alvarez del Villar, 1970:41 (key); Nelson & Rothman, 1973:173, fig. 12B (photo) (bibliography).

FAO Names : En - Pacific gizzard shad.



Diagnostic Features : Body moderately deep, its depth about 32 to 40% of standard length, belly with 15 to 18 + 9 to 12 scutes. Mouth small, inferior, lower jaw about 9 or 10% of standard length. Last dorsal finray long, but less than distance from snout tip to pelvic fin base; anal fin relatively short, with 22 to 29 finrays. Scales small, somewhat irregular, 71 to 79 in lateral series. A dark spot behind gill opening. Opisthonema species also have a filamentous last dorsal finray and a dark spot behind gill opening, but anal fin not longer than head and well behind dorsal fin base. Other clupeids lack dorsal filament.

Geographical Distribution : Pacific drainage of northwestern Mexico (Río Piaxtla, Río del Fuerte, Río Sinaloa system, Río de Mocorito, Río Muerto, Río Yaqui system, i.e. between Sinaloa and Sonora).

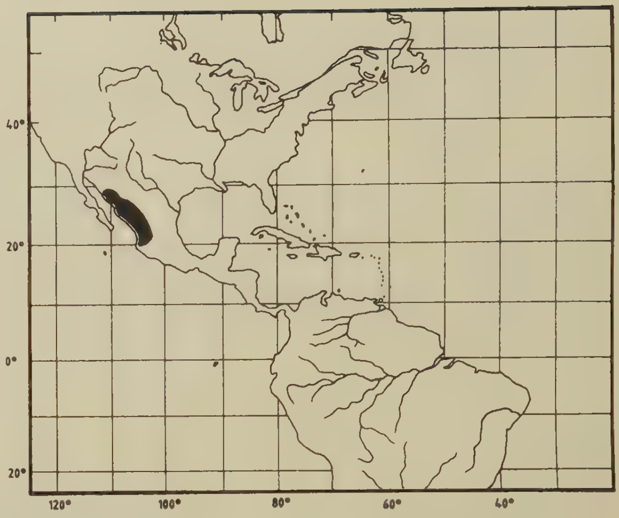
Habitat and Biology : Riverine, perhaps also lacustrine. More data needed, but presumably feeding and breeding similar to other Dorosoma species.

Size : To at least 14 cm standard length, perhaps more.

Interest to Fisheries : Perhaps of small local importance.

Local Names : -

Literature : Nelson & Rothman (1973 - 6 references).

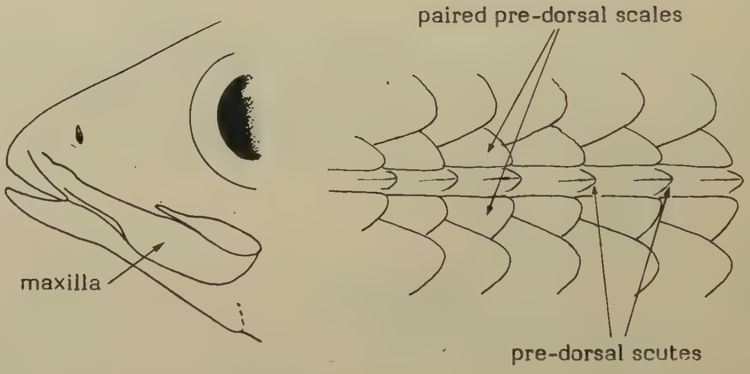


Clupanodon Lacepède, 1803

CLUP Clupan

Clupanodon Lacepède, 1803, Hist.nat.poiss., 5:465 (type: Clupea thrissa Linnaeus; designated by Bleeker, 1872:112. Subsequent invalid designations were Clupeonia jussieui Valenciennes = Sardinella jussieui, by Jordan & Gilbert, 1883:574; Clupea pilchardus Walbaum = Sardina pilchardus, by Jordan & Evermann, 1896:422; and Megalops oglina LeSueur = Opisthonema oglinum, by Jordan & Seale, 1905:771). Thrissa Rafinesque, 1815, Anal.nature:88 (type: Clupea thrissa Linnaeus since Thrissa proposed to replace Clupanodon).

Diagnostic Features : Medium-sized marine gizzard shads (to about 26 cm standard length); belly fully scuted, also pre-dorsal scutes present. Mouth subterminal; maxilla slender, not turned downward at tip, with a single spatulate supra-maxilla. Gillrakers fine and numerous (about 200 to 400, increasing with size of fish), at least 3/4 length of corresponding gill filaments on first arch. Last dorsal finray filamentous; anal fin shorter than head, with 22 to 28 finrays. Pre-dorsal scales paired, but not overlapping in midline. Dark spots on flanks. Closely resembles Konosirus, which lacks pre-dorsal scutes and has more ventral scutes (32 to 37; cf. 27 to 31 in Clupanodon). Species of Nematalosa have an inferior mouth with its edges flared outward.



Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : Nelson & Rothman (1973:164) included Konosirus punctatus in this genus, arguing that monotypy is infectious, thus inflating the rank of all species whenever new differences are found. However, the gizzard shads seem sufficiently well known to avoid this, and Konosirus is kept distinct here:

C. thrissa (Linnaeus, 1758), western North Pacific (also Andaman Sea).

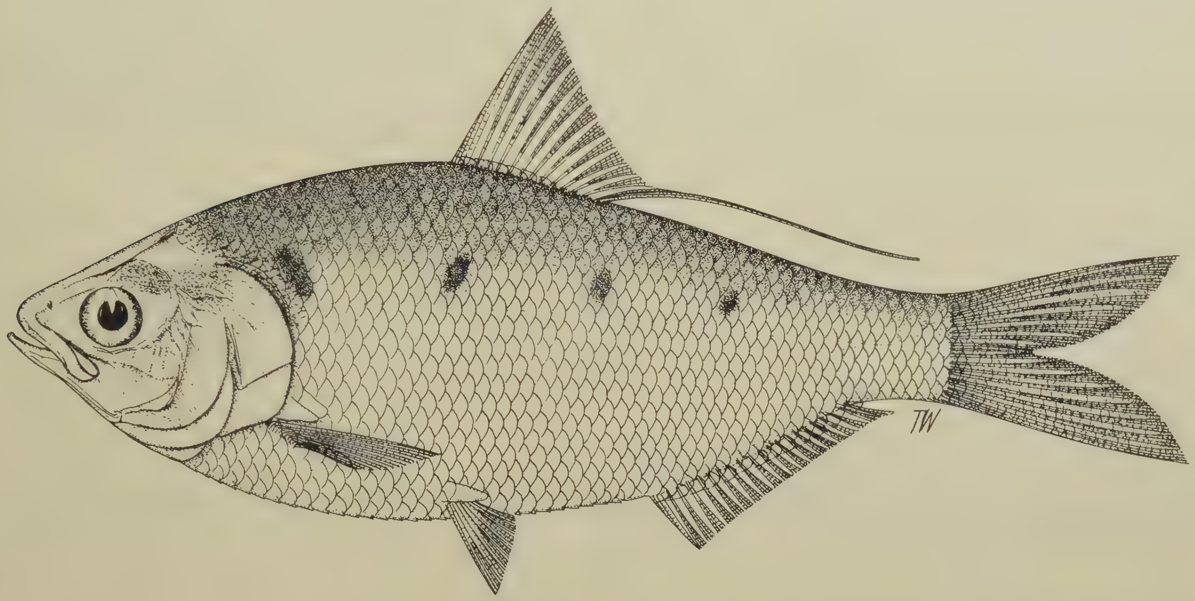
Clupanodon thrissa (Linnaeus, 1758)

CLUP Clupan 1

Clupea thrissa Linnaeus, 1758, Syst.nat., 10th ed., 1:318 (name from Osbeck, 1757:257; diagnosis derived from that for Mystus altus Linnaeus, 1754:26 - invalid).

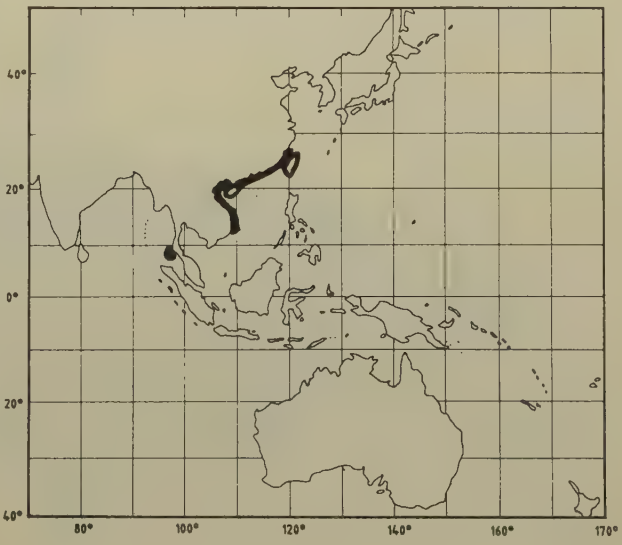
Synonyms : Clupea triza Linnaeus, 1759:251 (China); Chatoessus maculatus Richardson, 1846:308 (Vachell specimen from Canton, lost); Chatoessus osbeckii Valenciennes, 1847:106 (China); Chatoessus haihoensis Oshima, 1926:3 (Hainan); Clupanodon thrissa - Fowler, 1941:557 (Japan, China, the Philippines, ? Indonesia, but Bombay incorrect); Whitehead, 1962:100 (key, diagnostic features); Idem, 1966:34, 37 (Richardson's triza and maculatus); Idem, 1967:98 (types of osbeckii); Nelson & Rothman, 1973: 169, pl. 11A (photo), map 4 (synon., descr., refs); Wongratana, 1980:170, pls 118, 119 (revision); Whitehead & Bauchot, in press (types of osbeckii).

FAO Names : En - Chinese gizzard shad.



Diagnostic Features : Body moderately deep, its depth 33 to 37% of standard length, compressed, belly with 16 to 19 (usually 18) + 9 to 12 (usually 10 or 11) total 27 to 31 (usually 29 or 30) scutes; pre-dorsal scutes present, 17 to 26 (usually 20 to 25). Mouth subterminal; gillrakers of first arch at least 3/4 length of gill filaments. Last dorsal finray filamentous; anal finrays 22 to 28. Vertebrae 43 to 46 (usually 44 or 45). A dark spot behind gill opening, followed by further spots on flank. Resembles Konosirus punctatus, which is more slender (depth 28 to 33% of standard length), lacks pre-dorsal scutes and has more ventral scutes (32 to 37); species of Nematalosa have an inferior mouth and gillrakers not more than half length of gill filaments. Other clupeids lack a dorsal filament.

Geographical Distribution : Coasts and rivers of northwestern Pacific (China to about 25°N, apparently south to Viet Nam, but Philippine records of Fowler (1941) appear doubtful); specimens from Phuket I, Thailand (Andaman Sea), were recorded by Wongratana (1980:171).



Habitat and Biology : Coastal and in rivers, presumably tolerating brackishwater, if not fully fresh conditions. More data needed.

Size : To about 26 cm standard length.

Interest to Fisheries : Of small local interest (Liu & Shen, 1957 - Taiwan); the Korean catch in 1983 was 14 119 tons.

Local Names : CHINA: Hwang yu, Wong u (= Yellow fish - Canton).

Literature : Nelson & Rothman (1973 - 76 references).

Remarks : The ranges of *Clupanodon thrissa* and *Konosirus punctatus* overlap in the East China Sea (Hong Kong north to Taiwan); possibly the two have been confused in this area.

Konosirus Jordan & Snyder, 1900

CLUP Kono

Konosirus Jordan & Snyder, 1900, *Proc.U.S.natl.Mus.*, **23**:349 (type: *Chatoessus punctatus* Temminck & Schlegel. Subsequent invalid designation *Chatoessus nasus* Bloch = *Nematalosa nasus*, by Jordan, 1920) (misspelt *Konoshirus* by Jordan & Snyder, 1901:53). *Nealosa* Herre & Myers, 1931, *Lingnan Sci.J.*, (10):236 (type: *Chatoessus punctatus* Temminck & Schlegel).

Diagnostic Features : Medium-sized marine gizzard shads (to about 24 cm standard length); belly fully scuted, but no pre-dorsal scutes. Mouth sub-terminal; maxilla fairly slender, not turned downward at tip, with a single curved supra-maxilla. Gillrakers fine and numerous (about 150 to 250, increasing with size of fish), at least 3/4 length of corresponding gill filaments; anal fin shorter than head, with 19 to 27 finrays. Pre-dorsal scales paired, but not overlapping in midline. Dark spots on flanks. Closely resembles *Clupanodon*, which has pre-dorsal scutes and fewer ventral scutes (27 to 31; cf. 32 to 37). Species of *Nematalosa* have an inferior mouth with its edges flared outward.

Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : Opinions have been divided whether this genus deserves recognition (see under *Clupanodon*), but they are kept separate here, with a single species in each:

K. punctatus (Temminck & Schlegel, 1846), western North Pacific.

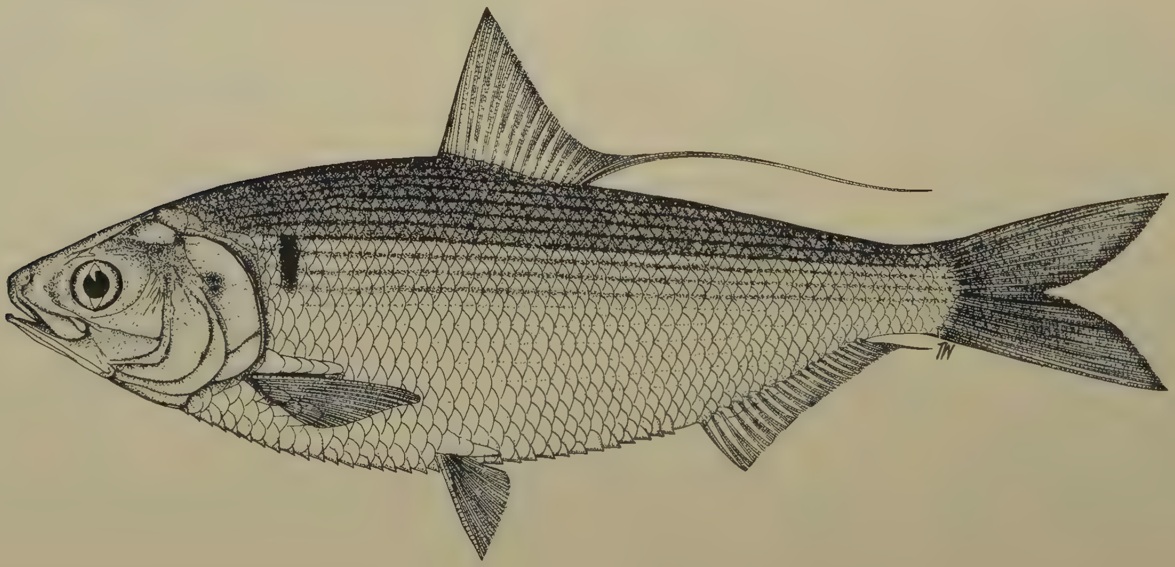
Konosirus punctatus (Temminck & Schlegel, 1846

CLUP Kono 1

Chatoessus punctatus Temminck & Schlegel, 1846, *Fauna Japonica, Poiss*, pt 5, inst. 13:240, pl. 109, fig. 1 (Japan, southern coast of Nagasaki).

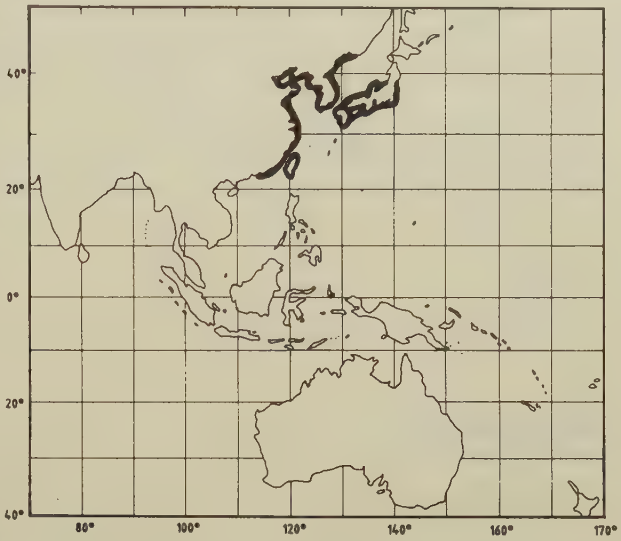
Synonyms : *Chatoessus aquosus* Richardson, 1846:307 (Hong Kong or Canton; Reeves specimen); *Nealosa punctata*:Herre & Myers, 1931:236 (Hong Kong); *Clupanodon punctatus*:Fowler, 1941:559 (Japan, Korea); Chu, Tchang & Chen, 1963:102, fig. 77 (East China Sea, review); Nelson & Rothman, 1973:164, fig. 10c (photo), map 4 (synon., descr., refs); *Konosirus punctatus* - Whitehead, 1962:100 (key, diagnostic features); *Idem*, 1966:33 (type of *aquosus*); Wongratana, 1980:172, pls 120, 121 (revision); Masuda *et al.*, 1984:19, pl. 22B (colour photo) (compiled).

FAO Names : En - Konoshiro gizzard shad.



Diagnostic Features : Body moderately slender, its depth 28 to 33% of standard length, moderately compressed, belly with 17 to 21 (usually 19 or 20) + 12 to 16 (usually 14 or 15), total 32 to 37 (usually 34 or 35) scutes; no pre-dorsal scutes. Mouth subterminal, snout projecting slightly; gillrakers of first arch at least 3/4 length of gill filaments. Last dorsal finray filamentous; anal finrays 19 to 27. Vertebrae 46 to 51 (usually 49, also 48 or 51). A dark spot behind gill opening, followed by several lines of dark dots along flank. Resembles Clupanodon thrissa, which has a deeper body (depth 33 to 37% of standard length), pre-dorsal scutes and fewer ventral scutes (27 to 31); species of Nematalosa have a more inferior mouth and gillrakers not more than half length of gill filaments. Other clupeids lack a dorsal filament.

Geographical Distribution : Coasts and rivers of northwestern Pacific (coasts of Japan southward from about 38°N, i.e. not Hokkaido; Sea of Japan north to Vladivostok on mainland; also Yellow Sea, including Gulf of Po-Hai and East China Sea south to Taiwan Island and Hong Kong).



Habitat and Biology : Marine, off coasts and in bays, but migrating into shallower brackishwater for breeding, at least in Ariake Sound (south Kyushu), where the fishes spawn far up the Sound in April and May, individual fishes apparently spawning twice or more in this season (Takita, 1978).

Size : To 25 cm standard length (at 2 years, but 4 year-old fishes occur and must be larger).

Interest to Fisheries : Occupies an important position in the fisheries of Ariake Sound (Takita, 1978) and probably elsewhere, but individual catches not recorded by FAO. Caught by trap nets and beach seines in Japan.

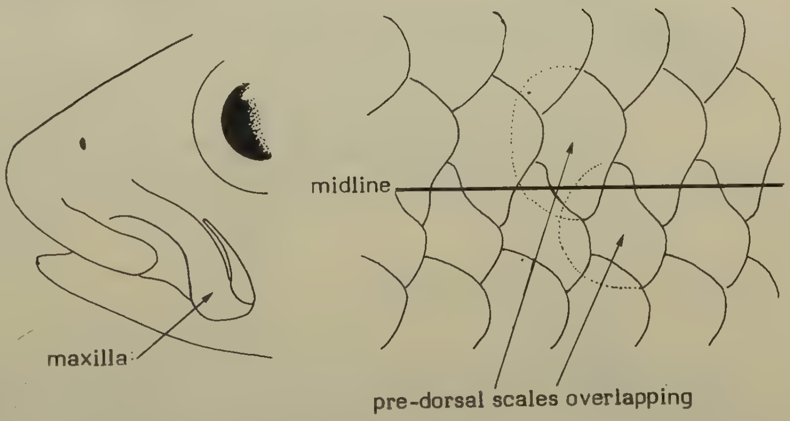
Local Names : JAPAN: Konoshiro.

Literature : Uchida et al. (1958 - eggs and larvae, figures; in Japanese); Takita (1978 - breeding, with refs to papers in Japanese on ecology); Nelson & Rothman (1973 - with 98 references to the species).

Nematalosa Regan, 1917

CLUP Nem

Nematalosa Regan, 1917, Ann.Mag.nat.Hist., (8)9:312 (type: Clupea nasus Bloch). Fluvialosa Whitley, 1943, Aust.Zool., 10(2):170 (type: Chatoessus elongatus Macleay).



Diagnostic Features : Medium-sized marine and riverine gizzard shads (to about 33 cm standard length); belly fully scuted. Mouth usually inferior, with snout rounded and projecting (nearer to subterminal in some species); edges of lower jaw flared outward, dentary bones meeting at an obtuse angle, sometimes forming an almost transverse cleft; pre-maxillae short, maxilla expanded at tip and actually or apparently turned downward, with a single small supra-maxilla. Gillrakers fine, numerous (up to 500 in some species), but fairly short, not more than half length of corresponding gill filaments on first arch. Last dorsal finray filamentous; anal fin shorter than head, with 17 to 26 finrays. Pre-dorsal scales paired and overlapping in midline. One (or more) dark spots on flanks in some species. Resembles Clupanodon and Konosirus, which have a more 'normal' clupeid mouth (edges of lower jaw not strongly flared outward) and paired pre-dorsal scales not overlapping in midline. Other Indo-Pacific gizzard shads and shads (Alosinae) lack a dorsal filament.

Biology, Habitat and Distribution : Some species marine, but passing into brackish- or freshwater, others purely fluviatile. Filter-feeders. Indo-Pacific region, from the eastern coasts of Africa to Australia and Japan.

Interest to Fisheries : Not recorded, but of limited local interest.

Species : Nelson & Rothman (1973) recognized 7 species, but Wongratana (1980) added two more; it seems possible that the wide-ranging N. nasus may be more than one species:

N. arabica Regan, 1917, northwestern Indian Ocean
N. come (Richardson, 1846), Australia to East China Sea
N. erebi (Günther, 1868), Australia
N. flyensis Wongratana, 1983, Papua New Guinea
N. galatheae Nelson & Rothman, 1973, India to Viet Nam
N. japonica Regan, 1917, Japan to Taiwan Island
N. nasus (Bloch, 1795), northern Indian Ocean to South China Sea
N. papuensis (Munro, 1964), Papua New Guinea
N. vlaminghi (Munro, 1956), Western Australia

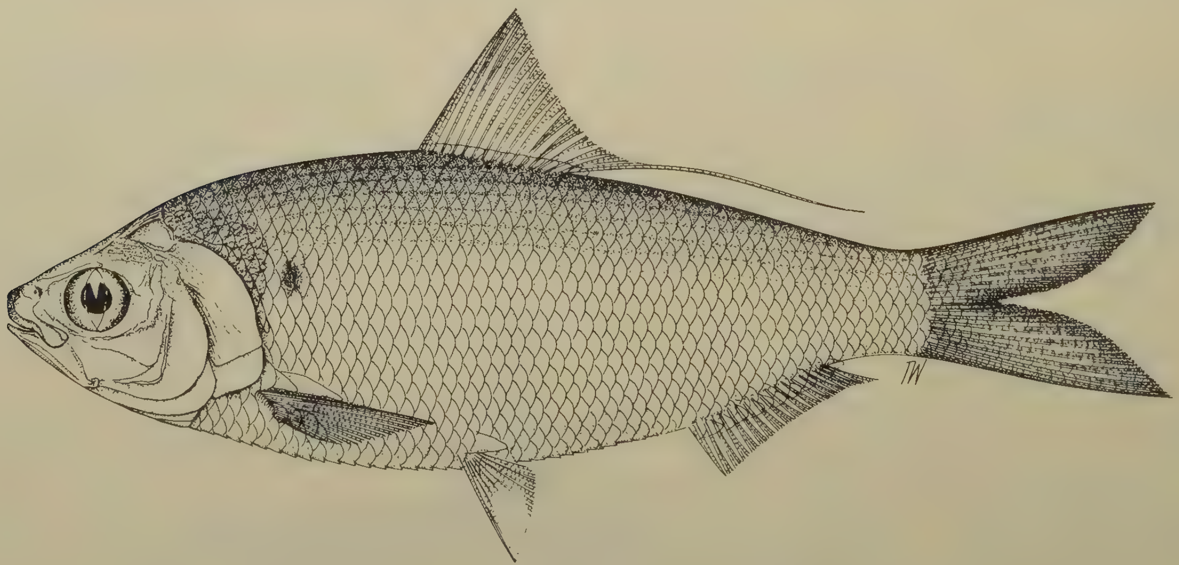
Nematalosa arabica Regan, 1917

CLUP Nem 2

Nematalosa arabica Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:313 (Muscat).

Synonyms : Nematalosa arabica - Fowler, 1941:554 (compiled); Whitehead, 1962:92 et seq., figs 1b, 2c, 3a (key, diagnostic features); Idem, 1965:261 (Gulf of Aden, key, descr.); Idem, 1973b:205, fig. 31 (key, refs); Nelson & Rothman, 1973:149, fig. 5B (photo) (synon., descr., refs); Wongratana, 1980:177, pls 126, 127 (revision).

FAO Names : En - Arabian gizzard shad.



Diagnostic Features : A marine gizzard shad; body rather deep, its depth 34 to 40% of standard length, compressed, belly with 17 or 18 + 10 to 15 scutes. Anterior arm of pre-operculum with a fleshy triangular area above, not covered by third infra-orbital bone (see N. come). Mouth subterminal, edge of lower jaw somewhat flared outward. Last dorsal finray filamentous. Hind edge of scales not toothed. A dark spot behind gill opening. Resembles N. nasus and N. galatheae, which have no fleshy gap above the anterior arm of the pre-operculum (since the third infra-orbital bone comes down to meet it); also, they have fewer scutes (total usually not more that 31; cf. 29 to 34 in N. arabica). No other clupeids in the area have a dorsal filament and inferior mouth.

Geographical Distribution : Northwestern Indian Ocean (Gulf of Aden to Gulf of Oman; no records from Red Sea or the "Gulf").

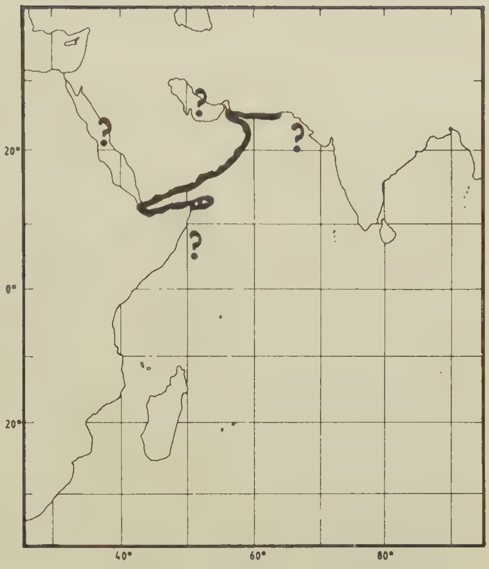
Habitat and Biology : Marine, pelagic. More data needed.

Size : To 16.5 cm standard length.

Interest to Fisheries : Not recorded.

Local Names : -

Literature : There appears to be no published study on its biology. Nelson & Rothman (1973) found only five references.



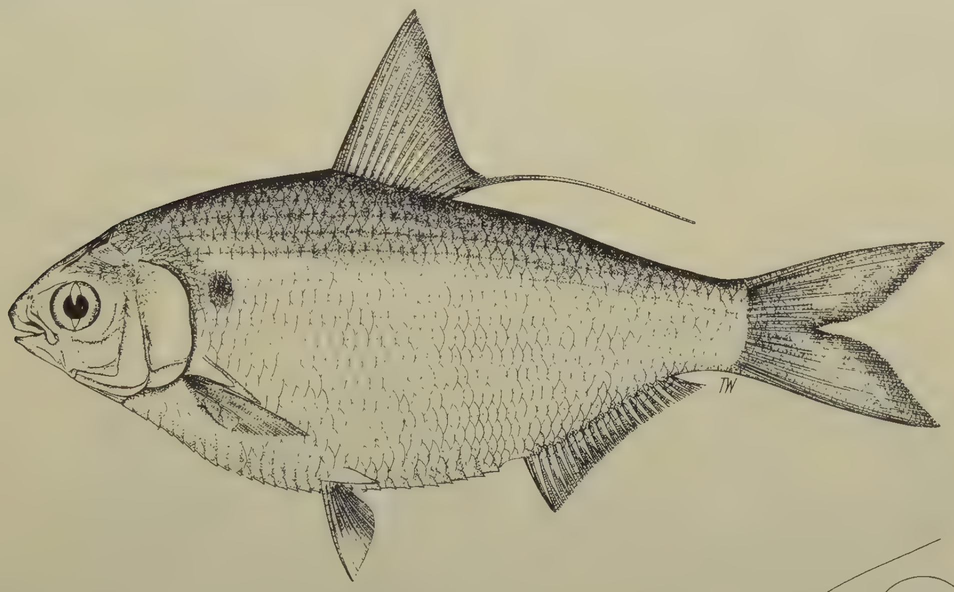
Nematalosa come (Richardson, 1846)

CLUP Nem-3

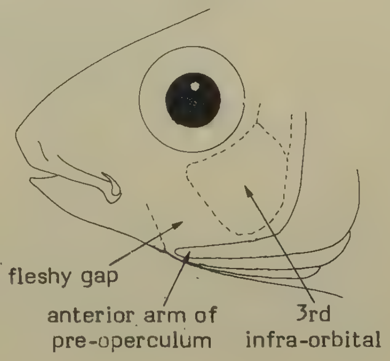
Chatoessus come Richardson, 1846, Ichthyol.Voy.Erebus & Terror:62, pl. 38, figs 7-10 (Western Australia).

Synonyms : Nematalosa come - Fowler, 1941:522 (compiled, but not all synonyms were this species, e.g. richardsoni and horni belong in N. erebi, as also refs to that species); Munro, 1956:25, fig. 176 (Australia, compiled); Idem, 1967:43, pl. 3, fig. 32 (Port Moresby, Papua New Guinea); Nelson & Rothman, 1973:150, pl. 5C (photo), map 2 (synon., descr., refs); Wongratana, 1980:178, pls 128, 129 (revision).

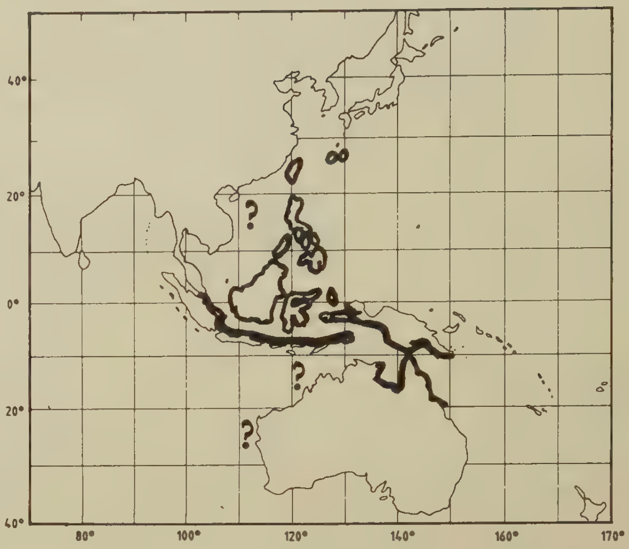
FAO Names : En - Western Pacific gizzard shad.



Diagnostic Features : A marine gizzard shad; body rather deep, its depth about 36 to 45% of standard length, compressed, belly with 18 or 19 (rarely 20) + 10 to 13 (usually 11 or 12), total 29 to 31 (usually 30) scutes. Anterior arm of pre-operculum with fleshy triangular area above, not covered by third infra-orbital bone. Mouth subterminal, edge of lower jaw strongly flared outward. Last dorsal finray filamentous; pectoral axillary scale well developed. Hind edge of scales not toothed. A dark spot behind gill opening. Range in East and South China Seas and perhaps in Java Sea overlaps that of N. nasus and possibly also N. galatheae, neither of which has a fleshy gap above anterior arm of pre-operculum (since the third infraorbital bone comes down to meet it); this also distinguishes the



freshwater N. erebi, N. papuensis and N. flyensis (which in addition have only rudimentary or absent pectoral axillary scales); in N. japonica the hind edge of the scales is distinctly toothed. No other clupeids in the area have a dorsal filament and inferior mouth.



Geographical Distribution : Western central Pacific (coasts of Queensland, Papua New Guinea and Irian Jaya (both on southern coasts only), Java Sea, the Philippines, north to East China Sea, i.e. Ryukyu Islands at about 23°N).

Habitat and Biology : Marine, pelagic. More data needed.

Size : To 21 cm standard length, usually about 15 to 18 cm.

Interest to Fisheries : Contributes to local clupeoid catches, but not of importance.

Local Names : AUSTRALIA: Hairback herring (Munro, 1956); JAPAN: Ryukyo-dorokui.

Literature : There appears to be no published study on its biology. Nelson & Rothman (1973) found 85 references.

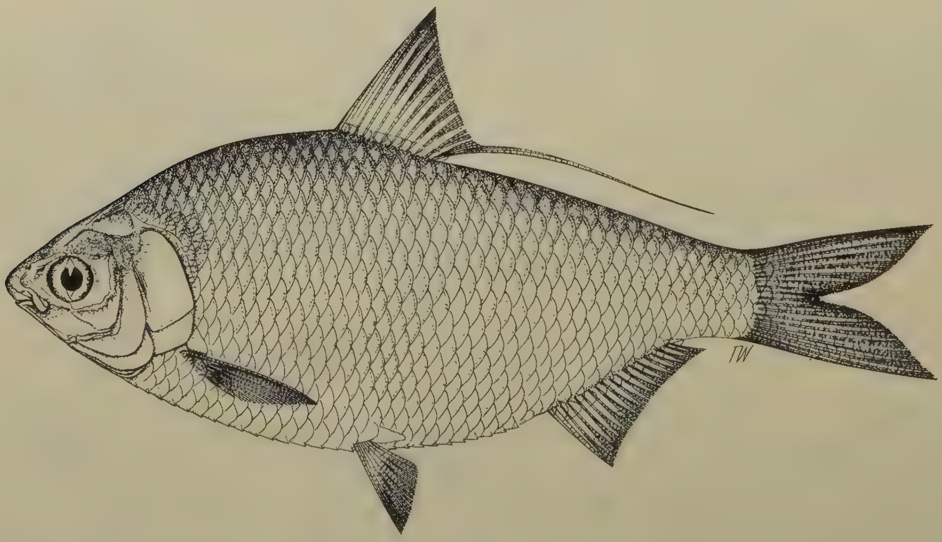
Nematalosa erebi (Günther, 1868)

CLUP Nem 4

Chatoessus erebi Günther, 1868, Cat.Fishes Brit.Mus., 7:407 (Mary River, Queensland).

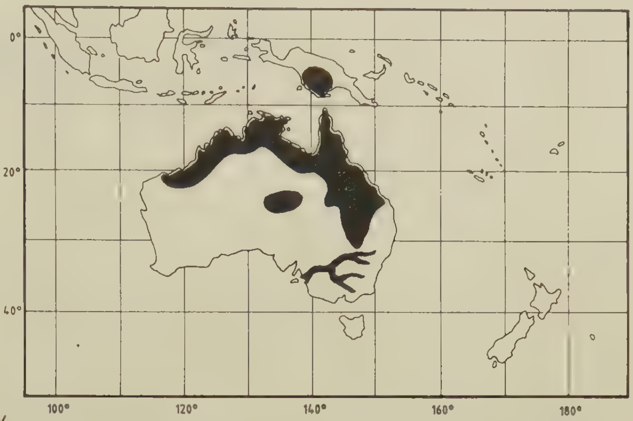
Synonyms : Chatoessus richardsoni Castelnau, 1873:144 (Murray River, Australia); Chatoessus elongatus Macleay, 1883:209 (Mary River, Queensland, Australia); Chatoessus horni Zeitz, 1896:180, pl. 16, fig. 6 (Finke River, Northern Territory, Australia); Nematalosa elongata:Fowler, 1941:554 (compiled); Fluvialosa bulleri Whitley, 1948:267 (Ord River, Western Australia); Fluvialosa paracome Whitley, 1948:267 (Fitzroy River, Western Australia); Fluvialosa richardsoni:Munro, 1956:26, fig. 178 (compiled); Scott, Glover & Southgate, 1974:71, fig. (South Australia); Fluvialosa bulleri:Munro, 1956:26, fig. 180 (compiled); Fluvialosa paracome:Munro, 1956:26, fig. 181 (compiled); Fluvialosa erebi:Munro, 1956:26, fig. 179 (compiled); Nematalosa erebi - Nelson & Rothman, 1973:152, figs 6, 7, 8A (photos), map 3 (synon., descr., refs); Wongratana, 1980:173, pls 122, 123 (revision).

FAO Names : En - Australian river gizzard shad.



Diagnostic Features : A riverine gizzard shad; body rather deep, its depth about 34 to 47% of standard length, compressed, belly with 14 to 18 (usually 16 to 17) - 11 to 14 (usually 12 or 13), total 25 to 31 (usually 20 to 30) scutes. Anterior arm of pre-operculum with a fleshy triangular area above, not covered by third infra-orbital bone (see N. come). Mouth inferior, edge of lower jaw strongly flared outward. Last dorsal finray filamentous; pectoral axillary scale rudimentary or absent. Hind edge of scales not toothed. A dark spot behind gill opening.

Overlaps northwestern Australian range of N. vlaminghi, which has hind edge of scales toothed. Other species of Nematalosa are marine, also pectoral axillary scales well developed. No other clupeids in the area have a dorsal filament and inferior mouth.



Geographical Distribution : Rivers of Australia and southwestern Papua New Guinea (from Fortesque River near Dampier Archipelago in Western Australia, eastward in rivers through the Northern Territory and Queensland south to the Murray - Darling system; also the Finke River, affluent to Lake Eyre; Digoel River in Papua New Guinea).

Habitat and Biology : Riverine, often far from sea, but also in estuaries; occurs in Lakes Albert and Alexandrina near mouth of Murray River. More data needed on food and breeding.

Size : To 32.5 cm standard length, usually 20 to 25 cm.

Interest to Fisheries : Of small local interest only.

Local Names : AUSTRALIA: Bony bream (various adjectives supplied by Munro, 1956 for the species which he recognized), Pyberry, Tukari.

Literature : There appears to be no published study of the biology of this species. Nelson & Rothman (1973) found 92 references.

Remarks : Nelson & Rothman (1973) found only small difference in meristic counts between specimens from different Australian rivers.

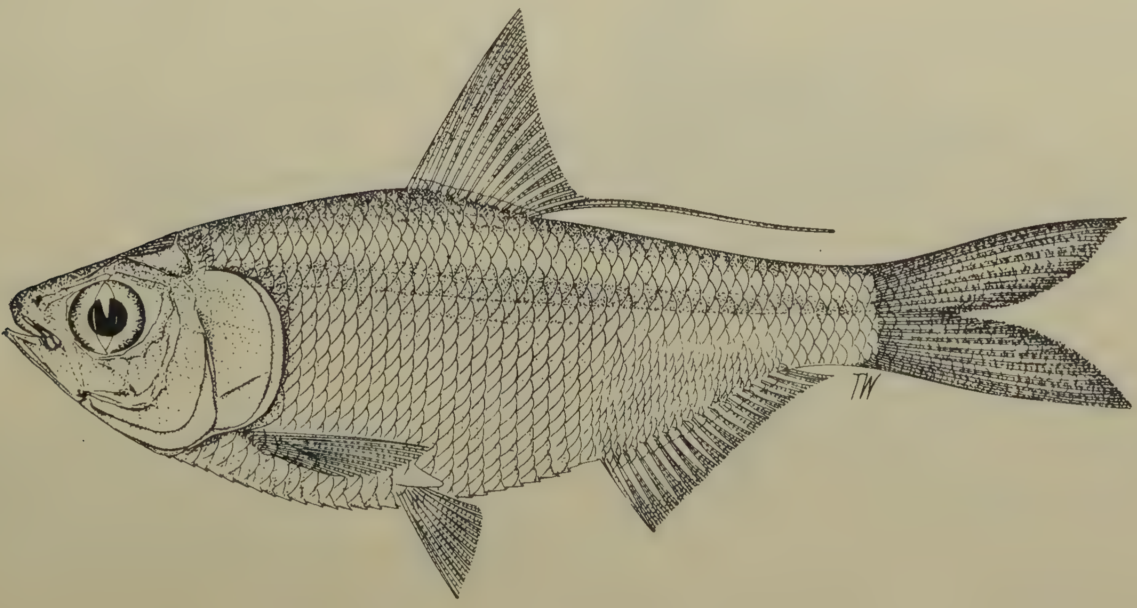
Nematalosa flyensis Wongratana, 1983

CLUP Nem 5

Nematalosa flyensis Wongratana, 1983, Jap.J.Ichthyol., **29**(4):393, fig. 9 (Toro Pass, Fly River, Papua New Guinea; based in part on a paratype of N. papuensis).

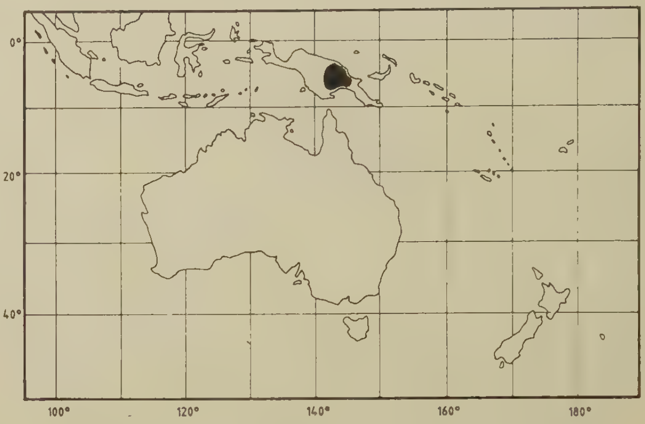
Synonyms : Nematalosa flyensis:Wongratana, 1980:184, pls 138, 139 (revision).

FAO Names : En - Fly river gizzard shad.



Diagnostic Features: A riverine gizzard shad; body rather deep, its depth about 32 to 40% of standard length, compressed, belly with 16 to 18 (usually 17) + 10 to 13 (usually 11 or 12), total 26 to 32 (usually 28 or 29) scutes. Anterior arm of pre-operculum with a fleshy triangular area above, not covered by third infra-orbital bone (see N. come). Mouth inferior, edge of lower jaw strongly flared outward. Last dorsal finray filamentous; pectoral axillary scales absent. Hind edge of scales toothed. No dark spot behind gill opening, but a faint band on flank. Sympatric with N. papuensis, which has fewer gillrakers (160 to 320 at 10 to 20 cm standard length; cf. 360 to 520), those on the lower arch being not more than 2/3 length of corresponding gill filaments (2/3 to equal in N. flyensis). All other Nematalosa in the area are marine and have well developed pectoral axillary scales.

Geographical Distribution: Papua New Guinea (only known from the Fly and Strickland rivers).



Habitat and Biology: Riverine, but no indication whether it descends to estuaries. More data needed.

Size: To 22.2 cm standard length, perhaps more.

Interest to Fisheries: Possibly makes a local contribution to river fisheries.

Local Names: -

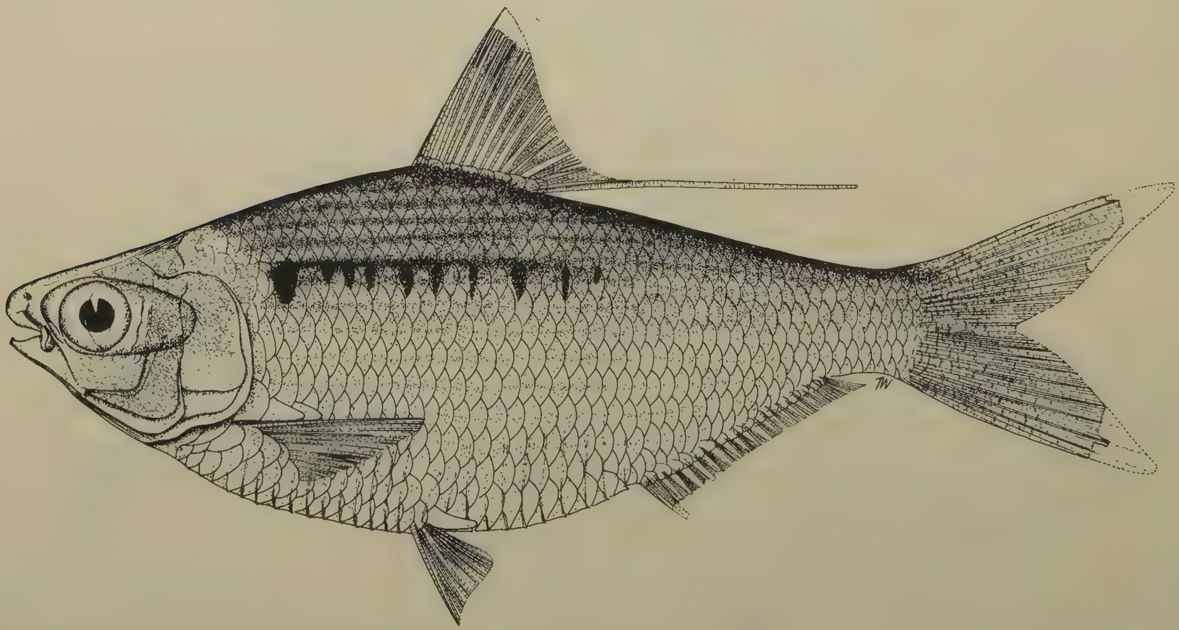
Nematalosa galatheae Nelson & Rothman, 1973

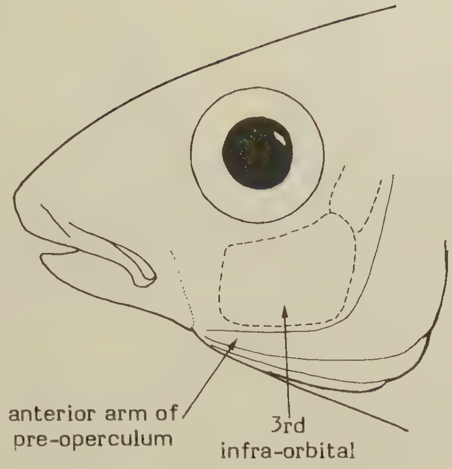
CLUP Nem 6

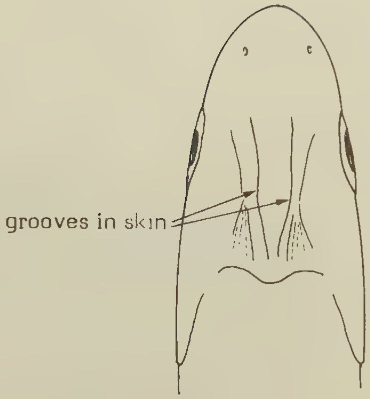
Nematalosa galatheae Nelson & Rothman, 1973, Bull.Am.Mus.nat.Hist., **150**(2):158, figs 8B, 9 (photos) (Ranong Province, Andaman Sea, Thailand, also mouth of Pakchan River).

Synonyms: Nematalosa nasus: Regan, 1917:313 (Canara, India only); Herre & Myers, 1937:13 (Singapore); Nematalosa chanpole: Wongratana, 1980:176, pls 124, 125 (revision - see Remarks for use of chanpole as the name for this species).

FAO Names: En - Galathea gizzard shad.

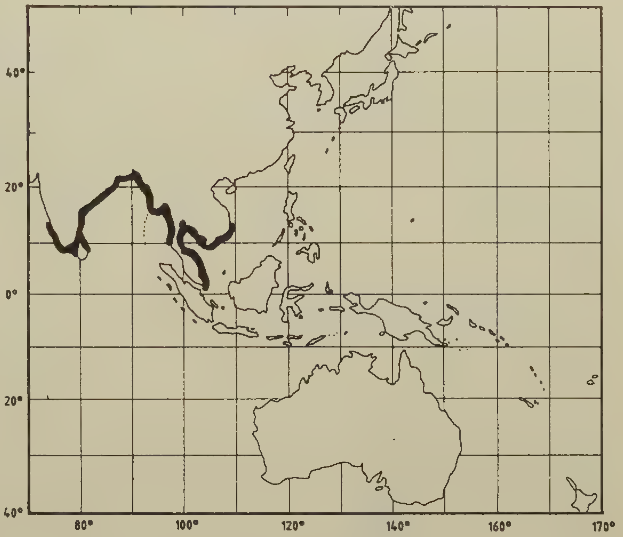






Diagnostic Features : A marine gizzard shad; body rather deep, its depth about 36 to 44% of standard length, compressed, belly with 16 or 17 (usually 17) + 8 to 11 (usually 10), total 25 to 30 (usually 28) scutes. Anterior arm of pre-operculum with the third infra-orbital bone immediately above it, no fleshy gap between. Mouth inferior, lower jaw strongly flared outward. A pair of grooves in the spongy skin on top of head, converging posteriorly. Last dorsal finray filamentous; pectoral axillary scale present. Hind edge of scales not toothed. A dark spot behind gill opening, followed by a series of smaller spots along flank. Closely resembles N. nasus, which lacks the pair of grooves on top of head and has the hind edge of the scales toothed; N. galatheae is the only Nematalosa with a series of spots on flank (at most a single spot behind gill cover in all others). No other clupeid in the area has a dorsal filament.

Geographical Distribution : Indian Ocean (southwest coast of India, presumably Bay of Bengal, off Andamana Sea coast of Thailand, Penang), Gulf of Thailand, Singapore, Viet Nam.



Habitat and Biology : Marine, but penetrating and presumably breeding in freshwater if Hamilton-Buchanan's Clupanodon chanpole is this species (see Remarks). More specimens and data needed.

Size : To 16.3 cm standard length.

Interest to Fisheries : Probably of local interest.

Local Names : INDIA: Chanpole (Ganges delta, if chanpole is this species - see Remarks).

Literature : There appears to be no study of its biology.

Remarks : Wongratana (1980:176) believed this species to be the Clupanodon chanpole of Hamilton-Buchanan (1822:249, pl. 18, fig. 74), a name hitherto placed in Anodontostoma (e.g. by Fowler, 1941:549 and Whitehead, 1973b:208). Hamilton-Buchanan's figure shows a fish with 5 spots along the flank (as in Nematalosa galatheae), but no dorsal filament (as in Anodontostoma); the dorsal view of the head does not show the pair of grooves characteristic of N. galatheae (as Wongratana claimed), but the freshwater provenance of chanpole ("ponds and ditches of every part of Bengal") seems to hint more at the freshwater species of Gonialosa (which lack a dorsal filament, but also lack spots on the flanks). The problem is left unresolved, with chanpole temporarily put in the synonymy of Anodontostoma chacunda.

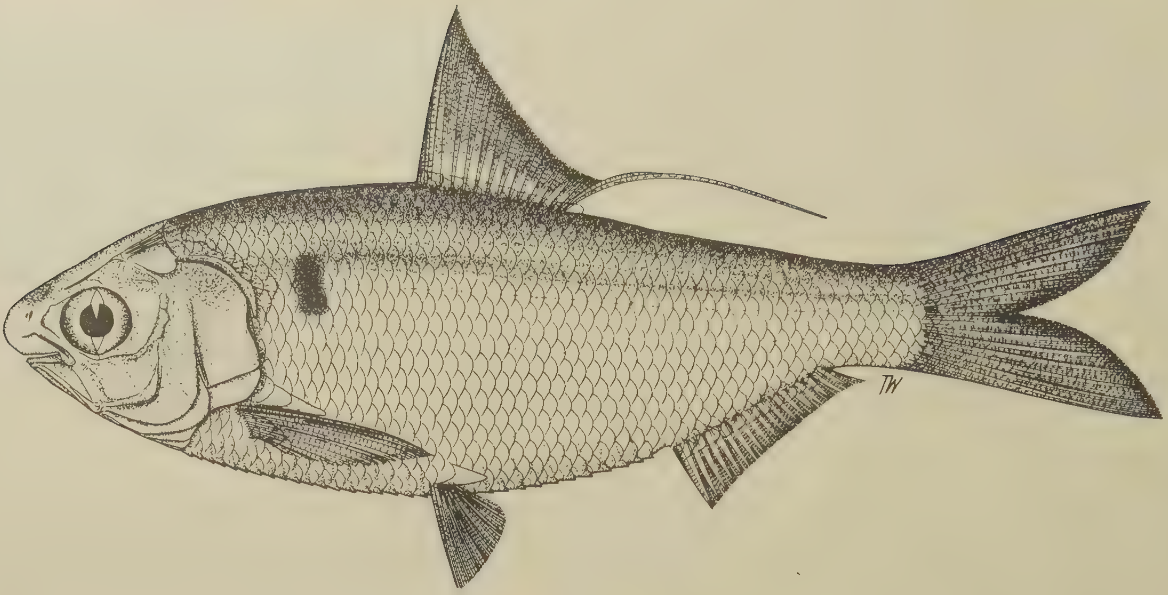
Nematalosa japonica Regan, 1917

CLUP Nem 7

Nematalosa japonica Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:313 (inland Sea of Japan).

Synonyms : Nematalosa japonica - Fowler, 1941:555 (compiled); Whitehead, 1962:101 (key, as japonicus); Nelson & Rothman, 1973:159, fig. 8C (photo) (synon., descr., refs); Masuda et al., 1975:166, pl. 13C (colour photo) (Matsushima Bay southward); Wongratana, 1980:180, pls 133, 134 (revision); Masuda et al., 1984:20, pl. 22C (colour photo) (southern Japan southward).

FAO Names : En - Japanese gizzard shad.



Diagnostic Features: A marine gizzard shad; body generally more slender than in other species, its depth 33 to 38% of standard length, belly with 16 to 19 (usually 18) + 13 to 16 (usually 13 or 14), total 30 to 34 (usually 32 or 33) scutes. Anterior arm of pre-operculum with a fleshy triangle above, not covered by third infra-orbital bone (see N. come). Mouth inferior, edge of lower jaw strongly flared outward. Last dorsal finray filamentous; pectoral axillary scale well developed. Hind edge of scales distinctly toothed. A dark spot behind gill opening. In southern part of range it overlaps N. nasus, perhaps also N. galatheae, both with no fleshy gap above the anterior arm of the pre-operculum (since the third infra-orbital bone comes down to meet it); also, scale edge smooth in N. galatheae (as well as in N. come, which reaches to the Ryukyu Islands). Both Clupanodon thrissa and Konosirus punctatus of Chinese and Chinese-Japanese waters have a dorsal filament, but mouth subterminal and gillrakers at least 3/4 length of gill filaments.

Geographical Distribution: Western Pacific (from Matsushima Bay, Sea of Japan, at about 36°N, southward to Taiwan Island, Hong Kong, the Philippines, and a single record from Gulf of Thailand).

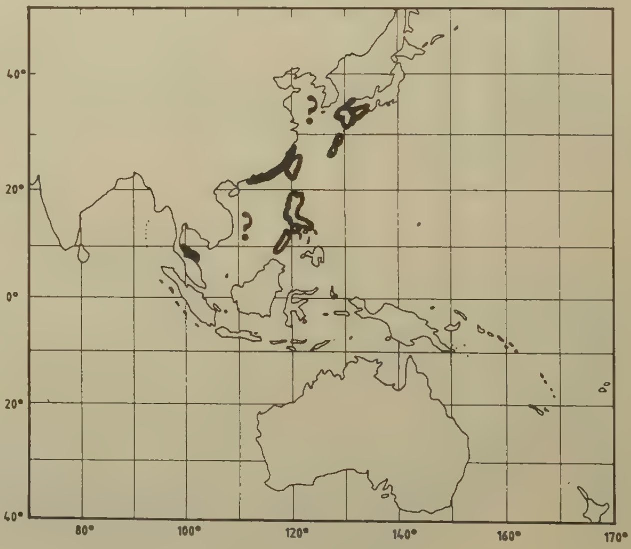
Habitat and Biology: Marine, preferring warmer water than Konosirus punctatus in Japan, schooling near shore over sand or mud. Filter-feeder. Breeds around May in Japanese waters.

Size: To about 19 cm standard length.

Interest to Fisheries: Of local interest in Japan, where it is caught by set net or gillnet.

Local Names: JAPAN: Dorokui.

Literature: Nelson & Rothman (1973) found 23 references.



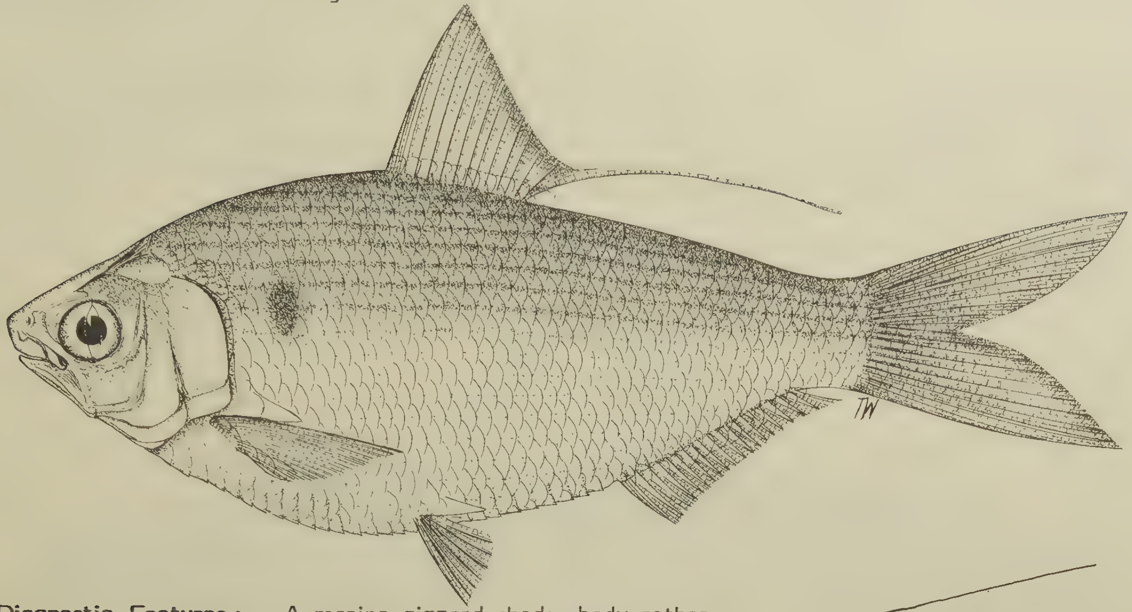
Nematalosa nasus (Bloch, 1795)

CLUP Nem 1

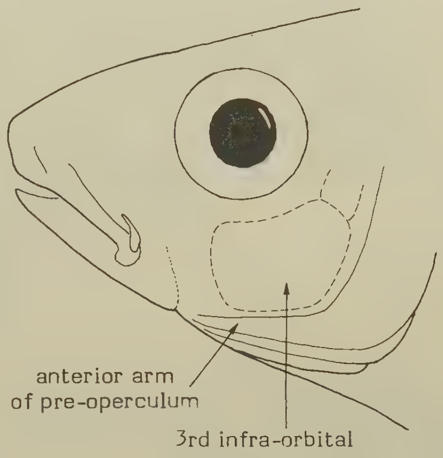
Clupea nasus Bloch, 1795, Naturgesch.ausl.Fische, **9**:116, pl. 429, fig. 1 (Malabar).

Synonyms: Clupanodon nasica Lacepède, 1803:468, 472 (Malabar; on C. nasus Bloch); ? Chatoessus altus Gray, 1834 (1 October):pl. 91, fig. 2 (India, no exact locality); ? Chatoessus chrysopterus Richardson, 1846:308 (Canton or Macao, on Reeves drawing); Nematalosa nasus - Fowler, 1941:555 (compiled; very complete synon.); Whitehead, 1962:97, fig. 4b (key, infra-orbital); Idem, 1965:262 (the "Gulf"); Idem, 1966:36 (identity of chrysoptera); Idem, 1969:272, pl. 2c (Bloch's pl.), fig. 1b (type of nasus); Idem, 1973b:204, fig. 30 (key, refs); Nelson & Rothman, 1973:161, fig. 10A (photo) (synon., descr., refs); Wongratana, 1980:179, pls 130, 131 (revision).

FAO Names : En - Bloch's gizzard shad.



Diagnostic Features : A marine gizzard shad; body rather deep, its depth about 34 to 41% of standard length, belly with 17 to 20 (usually 18) + 9 to 13 (usually 11), total 28 to 32 (usually 30) scutes. Anterior arm of pre-operculum with the third infra-orbital bone immediately above it, no fleshy gap between. Mouth inferior, lower jaw strongly flared outward. Last dorsal finray filamentous; pectoral axillary scale present. Hind edge of scales distinctly toothed. A dark spot behind gill opening. Resembles N. galatheae, which has spots along the flank and a smooth hind edge to scales; in west of range, overlaps N. arabica, and in east of range overlaps N. come and N. japonica, but all of these have a distinct fleshy triangular area above the anterior arm of the pre-operculum (i.e. third infra-orbital bone does not cover this area, but slopes backward), also, none have toothed scale edges. No other clupeid in the range of N. nasus has a filamentous dorsal finray. See CLUP Nem 1, Fishing Area 51, also Fishing Areas 57, 71.

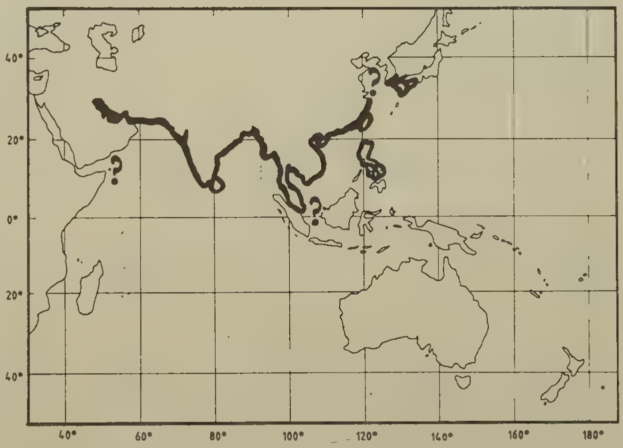


Geographical Distribution : Indian Ocean (the "Gulf", coasts of India to Andaman Sea), Gulf of Thailand, South China Sea to the Philippines, Hong Kong and north to southern Japan or southern tip of Korea). Not South Africa (Whitehead & Wongratana, i.e. SFSA, in press).

Habitat and Biology : Marine, pelagic, probably entering estuaries (e.g. specimen from Bassein River, Burma). Records of spawning in Chilka Lake, east coast of India, in August (Kowtal, 1970).

Size : To 21 cm standard length, usually about 15 cm.

Interest to Fisheries : No special fishery, but contributes to clupeid catches; in Saudi Arabia it is caught in set nets and traps, but commands only low to medium prices in markets (Wray, 1979).



Local Names : SAUDI ARABIA: Shroom.

Literature : Nelson & Rothman (1973) gave over a hundred references to this species; not included was Kowtal (1970) on eggs and larvae from Chilka Lake.

Remarks : The very wide range of this species suggests that it may be split into subspecies, although the published studies of Nelson & Rothman (1973) and Wongratana (1980) show rather little variation. Nevertheless, Nelson and Al-Hassan suspect one or more undescribed nasus- like species in the "Gulf".

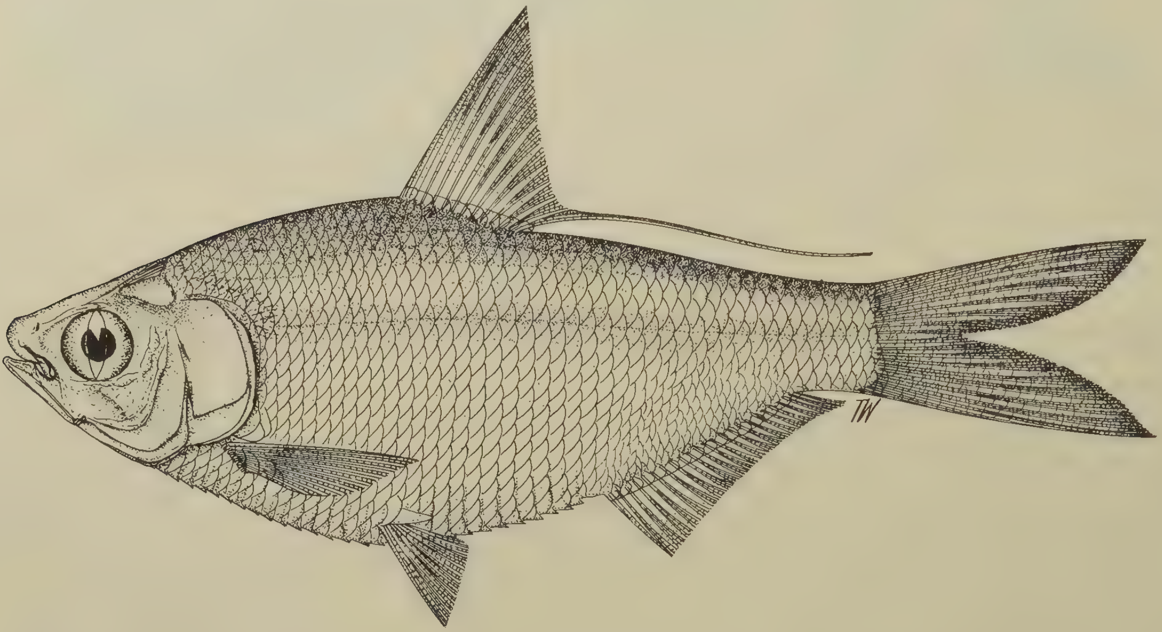
Nematalosa papuensis (Munro, 1964)

CLUP Nem 8

Fluvialosa papuensis Munro, 1964, *Papua New Guin.agric.J.*, **16**:152, fig. 3 (Strickland River, New Guinea; holotype only, the paratype being *N. flyensis*).

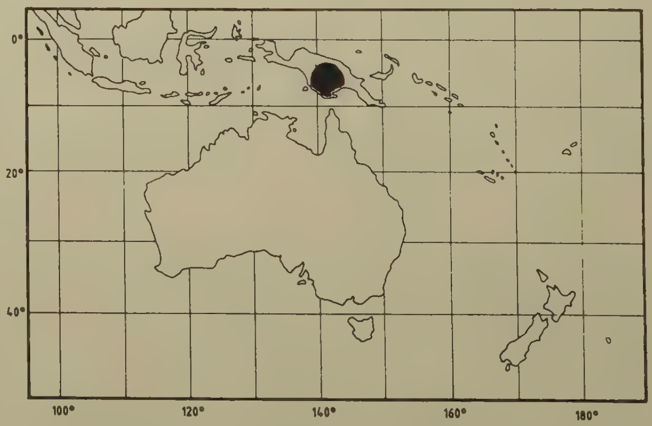
Synonyms : *Fluvialosa papuensis*:Munro, 1967:43, pl. 3, fig. 33 (upper part of Strickland River); *Nematalosa papuensis* - Wongratana, 1980:182, pls 136, 137 (revision).

FAO Names : En - Strickland river gizzard shad.



Diagnostic Features : A riverine gizzard shad; body rather deep, its depth about 32 to 40% of standard length, belly with 16 to 18 (usually 17) + 10 to 13 (usually 11 or 12), total 26 to 31 (usually 28 or 29) scutes. Anterior arm of pre-operculum with a fleshy triangular area above, not covered by third infra-orbital bone (see *N. come*). Mouth inferior, edge of lower jaw strongly flared outward. Last dorsal finray filamentous; pectoral axillary scales absent. Hind edge of scales toothed. No dark spot behind gill opening, but a band on fland. Sympatric with *N. flyensis*, which has more gillrakers (360 to 520 at 10 to 20 cm standard length; cf. 160 to 520), those on the lower arch being at least 2/3 length of corresponding gill filaments (about 1/5 to 2/3 in *N. papuensis*). Other species of *Nematalosa* are marine, also pectoral axillary scales well developed. No other clupeids in the area have a dorsal filament and inferior mouth.

Geographical Distribution : Papua New Guinea (only known from Fly and Strickland rivers).



Habitat and Biology : Riverine, but no indication whether it descends to estuaries. More data needed.

Size : To 20.7 cm standard length.

Interest to Fisheries : Possibly makes a local contribution to river fisheries.

Local Names : -

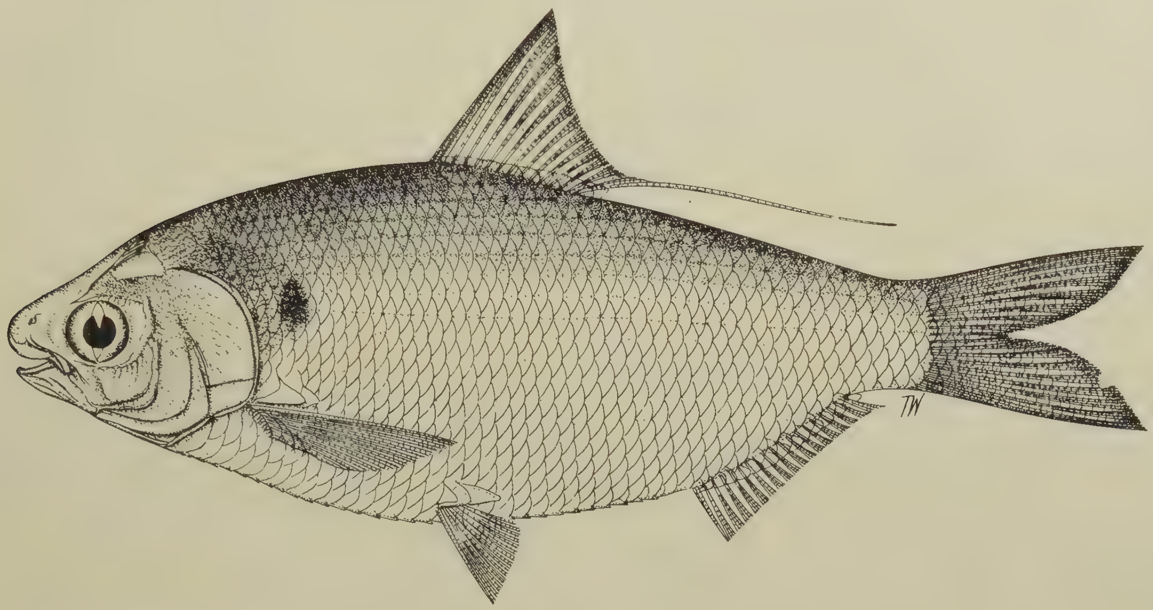
Nematalosa vlaminghi (Munro, 1956)

CLUP Nem 9

Fluvialosa vlaminghi Munro, 1956, Fish Newsletter, 25(12):25, fig. 177 (Swan River, Western Australia).

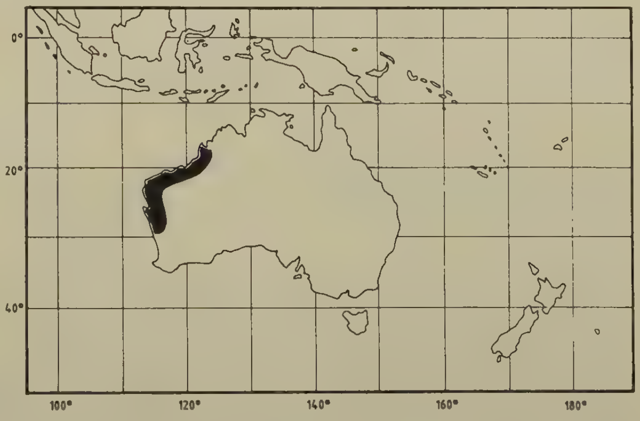
Synonyms : Nematalosa vlaminghi - Nelson & Rothman, 1973:163, fig. 10B (photo), map 2 (synon., descr., refs); Wongratana, 1980:181, pl. 135 (revision); Hutchins & Thompson, 1983:18, 75, fig. 55 (Bunbury to Broome, compiled).

FAO Names : En - Western Australian gizzard shad.



Diagnostic Features : A marine and estuarine gizzard shad; body rather deep, its depth about 36 to 40% of standard length, compressed, belly with 16 to 19 (usually 18) + 12 to 14 (usually 12), total 28 to 32 (usually 31) scutes. Anterior arm of pre-operculum with a fleshy triangular area above, not covered by third infra-orbital bone (see N. come). Mouth inferior, lower jaw strongly flared outward. Last dorsal finray filamentous; a small pectoral axillary scale present. Hind edge of scales toothed. A dark spot behind gill opening. Overlaps range of the riverine N. erebi and the marine N. come, which have the hind edge of the scales smooth. Nematalosa is the only clupeid with a dorsal filament and inferior mouth in this area.

Geographical Distribution : Western Australia (from Bunbury, south of Perth, north and eastward to Broome).



Habitat and Biology : Marine and estuarine (given as fluviatile by Munro (1956), but Nelson & Rothman (1973) failed to record any truly freshwater specimens), abundant in estuaries, also found in coastal embayments (Hutchins & Thompson, 1983). More data needed.

Size : To 19 cm standard length.

Interest to Fisheries : Of local interest only.

Local Names : AUSTRALIA: Bony bream, Perth herring.

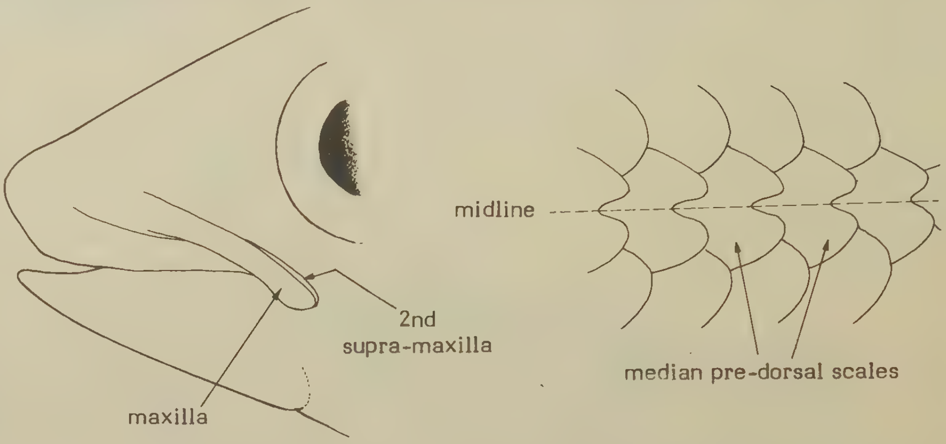
Literature : There appears to be no study of its biology. Nelson & Rothman (1973) found only five references.

Remarks : Wongratana (1980:182) found gillraker differences in different areas, suggesting that the populations are isolated, but more material is needed.

Anodontostoma Bleeker, 1849

CLUP Anod

? Gonostoma van Hasselt, 1823, Algemeene Konst- en Letter-bode, **1**(21):329 (type: none given; not Gonostoma Rafinesque, 1810). Anodontostoma Bleeker, 1849, Verh.batav.Genoot.Kunst.Wet., **22**:15 (type: Anodontostoma hasseltii Bleeker = Clupanodon chacunda Hamilton-Buchanan).



Diagnostic Features : Small or moderate-sized marine gizzard shads (but entering rivers) (to about 18 cm standard length); body very deep, its depth 40 to 75% of standard length in fishes over 9 cm, belly fully scuted. Mouth subterminal or a little inferior, upper jaw slender at tip and not strongly turned down, a single slender or even splint-like second supra-maxilla; lower jaw short, its edges strongly flared outward. Gillrakers fine and numerous (50 to 170 on lower arch). Last dorsal finray not filamentous; anal fin much shorter than head, with 17 to 25 (usually 19 to 21) finrays. Pre-dorsal scales forming a single median series, post-dorsal scales with hind margin elongated. Scales moderately large, 38 to 45 in lateral series. A dark spot behind gill opening. Resembles the freshwater Gonialosa in lacking a dorsal filament, but in that genus the pre-dorsal scales are paired, there are 22 to 28 (usually 24 to 26) anal finrays and the upper jaw turns down strongly at its tip. Other Indo-Pacific gizzard shads have a dorsal filament; the mouth is terminal in the Alosinae (Hilsa, Tenualosa, Gudusia) and other clupeids.

Biology, Habitat and Distribution : Marine, but entering freshwater, from the "Gulf" to northern Australia, the Caroline Islands and New Caledonia.

Interest to Fisheries : No specific fisheries, but of limited local interest.

Species : To the 2 species (chacunda and chanpole) mostly accepted by earlier authors, Wongratana (1983) added a third, but identified Hamilton-Buchanan's chanpole as a Nematalosa and resurrected Bleeker's selangkat; chanpole is here recognized as a synonym of chacunda:

A. chacunda (Hamilton-Buchanan, 1822), Indo-West Pacific
A. selangkat (Bleeker, 1852), eastern Indian Ocean and Indonesia
A. thailandiae Wongratana, 1983, Thailand, Indonesia.

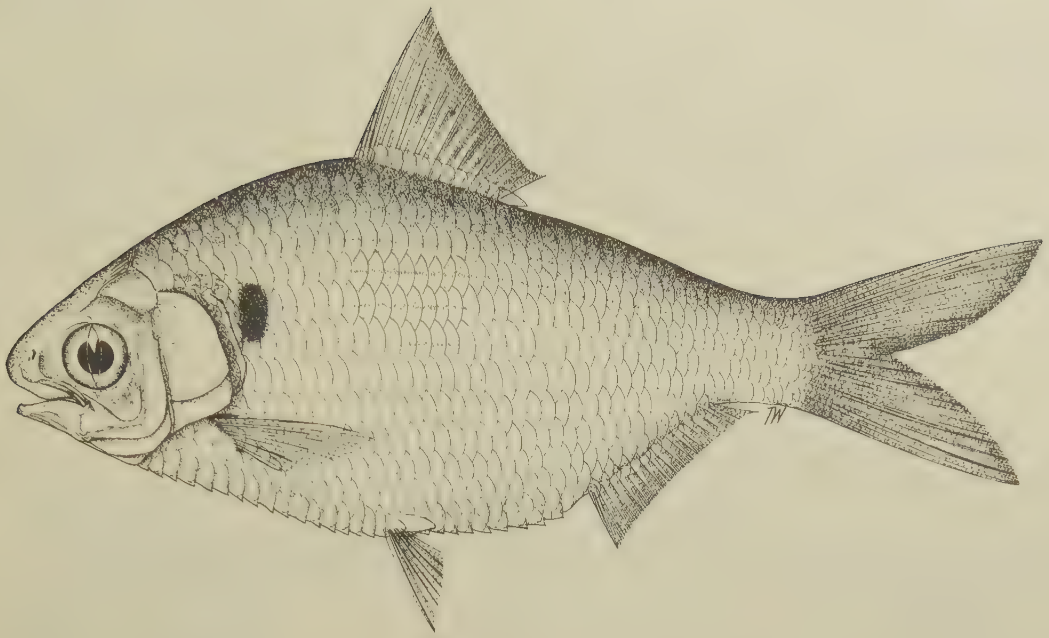
Anodontostoma chacunda (Hamilton-Buchanan, 1822)

CLUP Anod 1

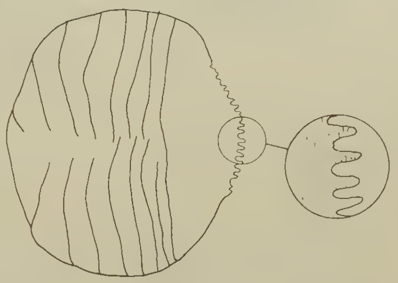
Clupanodon chacunda Hamilton-Buchanan, 1822, Fishes of Ganges:246 (Ganges estuaries).

Synonyms : Clupanodon chanpole Hamilton-Buchanan, 1822:249, pl. 18, fig. 74 (Ganges); ? Gonostoma sp. van Hasselt, 1823:329 ("die zeer veel overeenkomst heeft met Meg. Naso Lacep.", but without dorsal filament; see Alfred, 1961 for notes on van Hasselt's fishes); Anodontostoma hasseltii Bleeker, 1849:15 (Madura Strait, Java Sea); Gonostoma javanicum Hyrtl, 1855:49 (Java); Anodontostoma chacunda - Fowler, 1941:549 (the Philippines, 'Borneo', Java, India; key, very large synon. descr.); Whitehead, 1962:101 (key); Idem, 1965:263 (the "Gulf"); Whitehead, Boeseman & Wheeler, 1966:88, 89, pl. 11, fig. 1 (Bleeker's fig.) (types of hasseltii, selangkat); Nelson & Rothman, 1973:141, figs 1C, 4A, B (photos), map 1 (synon., descr., very large list of refs); Whitehead, 1973b:207, fig. 33 (key, refs); Wongratana, 1980:188, pls 146, 147 (revision).

FAO Names : En - Chacunda gizzard shad.

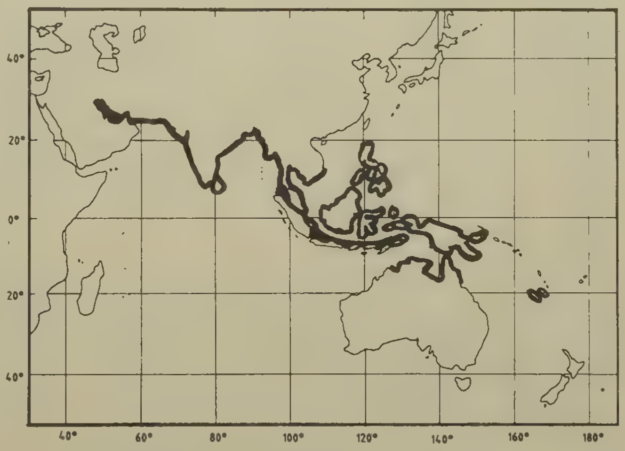


Diagnostic Features : A marine gizzard shad; body very deep, its depth increasing with size of fish, 40 to 70% of standard length in fishes over 10 cm. Mouth inferior; second supra-maxilla a mere splint. Lower gillrakers 54 to 96; longest gillrakers on lower part of arch less than corresponding gill filaments (and much less in larger fishes). Last dorsal finray not filamentous. Hind edges of scales toothed, the teeth thinner than gaps between them; a median series of pre-dorsal scales. A large black spot behind gill opening. Resembles *A. selangkat*, which has more lower gillrakers (100 to 166) and teeth on scales wider than gaps between, and *A. thailandiae*, which has the longest gillrakers on lower part of arch at least as long as corresponding gill filaments, also second supra-maxilla paddle-shaped. Species of *Gonialosa* and *Nematalosa* have paired pre-dorsal scales, also a dorsal filament in the latter. Other clupeids have a terminal mouth. See CLUP Anod 1, Fishing Area 51, also Fishing Areas 57, 71.



scale

Geographical Distribution : Indian Ocean (the "Gulf" to coasts of India and Andaman Sea), western Pacific (Gulf of Thailand to northern Australia, the Caroline Islands and New Caledonia; also Indonesia, the Philippines and Viet Nam).



Habitat and Biology : Marine, pelagic and inshore, also in estuaries. Feeds on diatoms, radiolarians, molluscs, copepods and crustaceans (in that order of importance, at least in the Godavari estuary). Breeds from November to February, mainly in the later part (Godavari estuary).

Size : To 17.5 cm standard length, common around 10 to 14 cm.

Interest to Fisheries : Local contributions, e.g. November to June in Godavari estuary, but no special fishery.

Local Names : INDIA: Chacunda; INDONESIA: Selangkat, Trubala (Malay), Lakar, Penden, Slamat (Java), Bandring, Djangan (Madura), Belo (Sunda), Pias (Bagan Api-Api).

Literature : Chacko (1954 - breeding); Babu Rao (1965 - general biology); further references in Whitehead (1973b) and over a hundred in Nelson & Rothman (1973), although at least some of these must refer to the sympatric species *A. selangkat* and *A. thailandiae*.

Remarks : For identity of Hamilton-Buchanan's *chanpole*, see under *Nematalosa galatheae*.

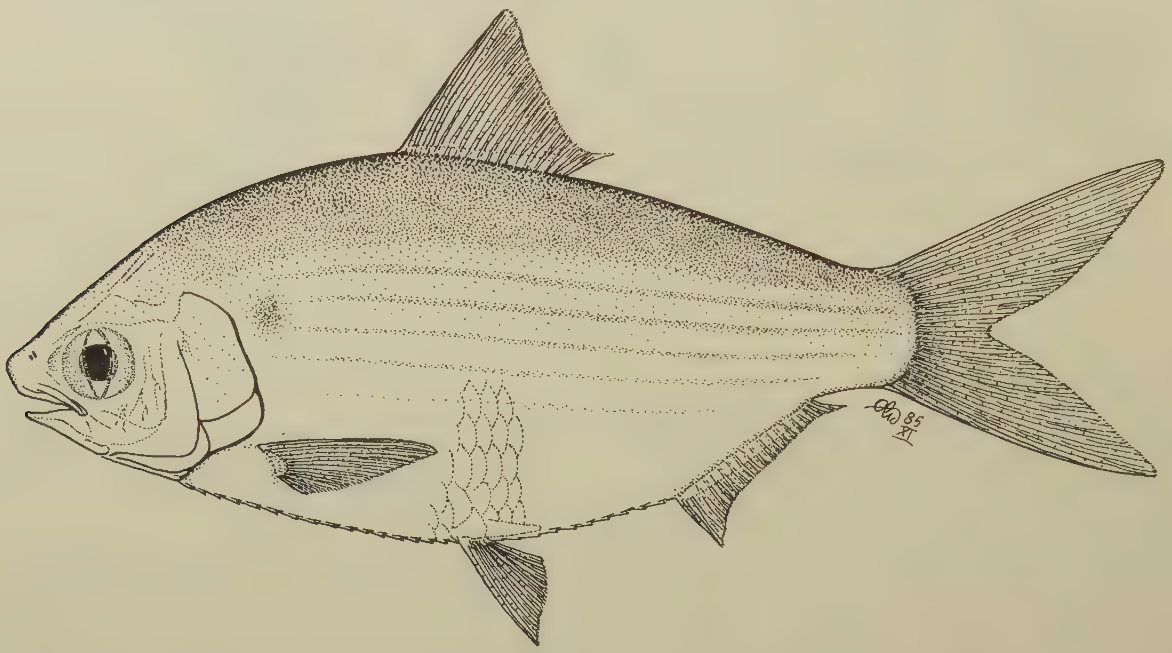
Anodontostoma selangkat (Bleeker, 1852)

CLUP Anod 2

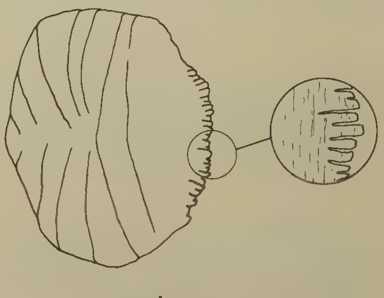
Chatoessus selangkat Bleeker, 1852, Natuurk.Tjdschr.Ned.-Indië, 3:458 (Muntok, Batavia).

Synonyms : Chatoessus breviceps Peters, 1877:838 (New Hanover); Anodontostoma chacunda:Whitehead, Boeseman & Wheeler, 1966:89, pl. 11, fig. 1 (Bleeker's figure) (type of selangkat); numerous authors who placed selangkat in the synonymy of chacunda; Anodontostoma selangkat - Wongratana, 1980:191, pls 148, 149 (revision).

FAO Names : En - Indonesian gizzard shad.



Diagnostic Features : A marine gizzard shad; body very deep, its depth increasing with size of fish, 40 to 75% of standard length in fishes over 9 cm. Mouth inferior; second supra-maxilla a mere splint. Lower gillrakers 100 to 166; longest gillrakers on lower part of arch less than corresponding gill filaments (and much less in larger fishes). Last dorsal finray not filamentous. Hind edges of scales toothed, the teeth wider than gaps between them; a median series of pre-dorsal scales. A large dark mark behind gill opening, followed by longitudinal streaks along flanks. Resembles A. chacunda, which has fewer lower gillrakers (54 to 96) and teeth on scales thinner than gaps between them, and A. thailandiae, which has the longest gillrakers on lower part of arch at least as long as corresponding gill filaments, also second supra-maxilla paddle-shaped. Species of Gonialosa and Nematalosa have paired pre-dorsal scales, also a dorsal filament in the latter. Other clupeids have a terminal mouth.



scale

Geographical Distribution : Indian Ocean (Andaman Islands - a single Day specimen), Java Sea, the Philippines and eastward to Bismark Archipelago (type locality of breviceps).

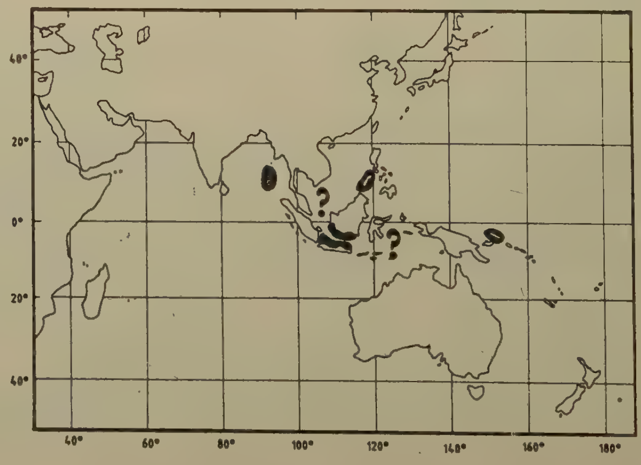
Habitat and Biology : Marine, pelagic and inshore (probably a similar biology to A. chacunda).

Size : To 18 cm standard length.

Interest to Fisheries : No data.

Local Names : Not distinguished from A. chacunda.

Literature : Confused with A. chacunda by authors prior to Wongratana (1980).



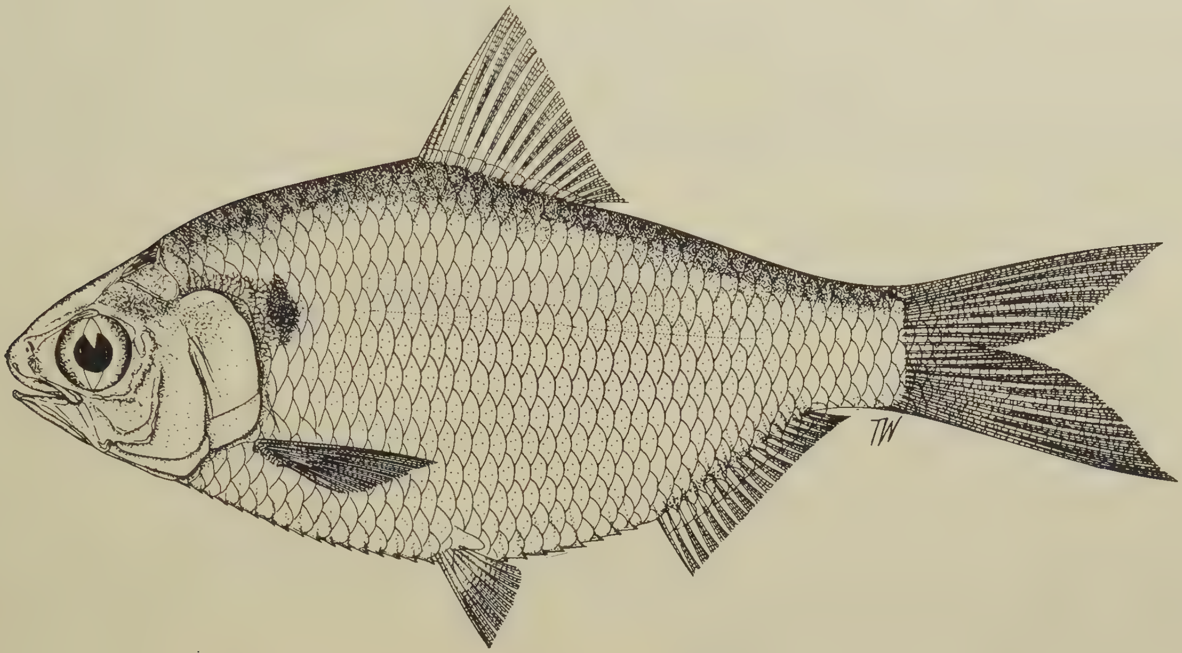
Anodontostoma thailandiae Wongratana, 1983

CLUP Anod 3

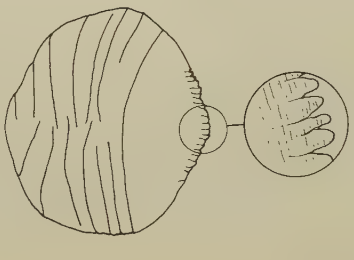
Anodontostoma thailandiae Wongratana, 1983, *Jap.J.Ichthyol.*, **29** (4):394, fig. 11 (Songkhla, Gulf of Thailand, also Calcutta, Bangladesh, Phuket, northern Sumatra, Borneo, Sarawak).

Synonyms : *Anodontostoma chacunda*:numerous authors.

FAO Names : En - Thai gizzard shad.

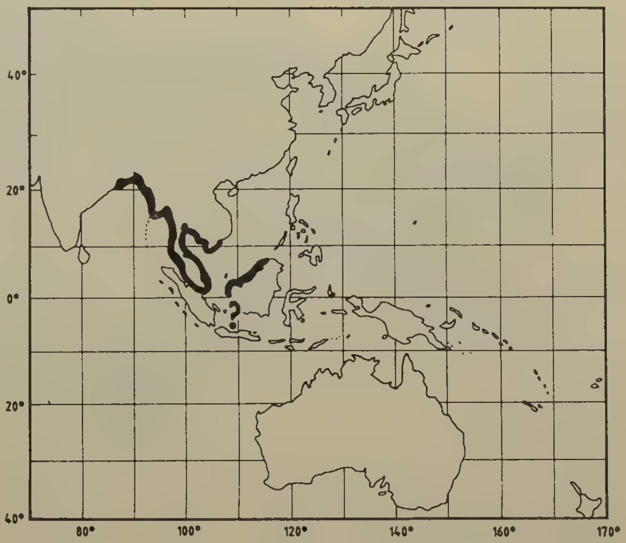


Diagnostic Features : A marine gizzard shad; body very deep, its depth increasing with size of fish, about 40 to 68% of standard length in fishes over 8 cm. Mouth inferior; second supra-maxilla paddle-shaped. Lower gillrakers 46 to 140; longest gillrakers on lower part of arch equal to or longer than corresponding gill filaments. Last dorsal finray not filamentous. Hind edges of scales toothed, the teeth wider than gaps between them; a median series of pre-dorsal scales. A large dark mark behind gill opening. Resembles *A. chacunda* and *A. selangkat*, which have lower gillrakers shorter than corresponding gill filaments and the second supra-maxilla a mere splint. Species of *Gonialosa* and *Nematalosa* have paired pre-dorsal scales, also a dorsal filament in the latter. Other clupeids have a terminal mouth.



scale

Geographical Distribution : Indian Ocean (northern part of Bay of Bengal, Andaman Sea at Phuket in Thailand), Gulf of Thailand, South China Sea, ? Java Sea.



Habitat and Biology : Marine, pelagic and inshore, probably entering estuaries (probably a similar biology to *A. chacunda*).

Size : To 18 cm standard length, usually 10 to 14 cm.

Interest to Fisheries : No data.

Local Names : Not distinguished from *A. chacunda*.

Literature : Confused with *A. chacunda* by authors prior to Wongratana (1983).

Gonialosa Regan, 1917

CLUP Gon

Gonialosa Regan, 1917, Ann.Mag.nat.Hist., (8)**19**:315 (type: Chatoessus modestus Day, designated by Jordan, 1920:560). Indialosa Herre & Myers, 1941, Lingnan Sci.J., (10):238 (type: Clupanodon manmina Hamilton-Buchanan).

Diagnostic Features : Small freshwater gizzard shads (to about 12 cm standard length); belly fully scuted. Mouth usually inferior (sub-terminal in one), upper jaw actually or apparently turned down at tip, short, rarely reaching front margin of eye, a single supra-maxilla; lower jaw short, its edges strongly flared outward. Gillrakers fine and numerous (90 to 180 on lower arch). Last dorsal finray not filamentous; anal fin equal to or a little shorter than head, with 22 to 28 (usually 24 to 26) finrays. Pre-dorsal scales paired and overlapping in midline. Scales moderate or small, 43 to 71 in lateral series. A dark spot behind gill opening. Resembles Anodontostoma in lacking a dorsal filament, but in that genus the pre-dorsal scales form a single median row, there are only 17 to 25 (usually 19 to 21) anal finrays and the upper jaw does not turn down at its tip. Other Indo-Pacific gizzard shads have a dorsal filament; the mouth is terminal in the Alosinae (Hilsa, Tenualosa, Gudusia) and other clupeids.

Biology, Habitat and Distribution : Freshwater in rivers of India, Bangladesh and Burma.

Interest to Fisheries : No specific fisheries, but of limited local interest.

Species : To the 2 species accepted since the revision by Regan (1917), Wongratana (1983) added a third:

G. manmina (Hamilton-Buchanan, 1822), Ganges
G. modesta (Day, 1869), Burma
G. whiteheadi Wongratana, 1983, Burma.

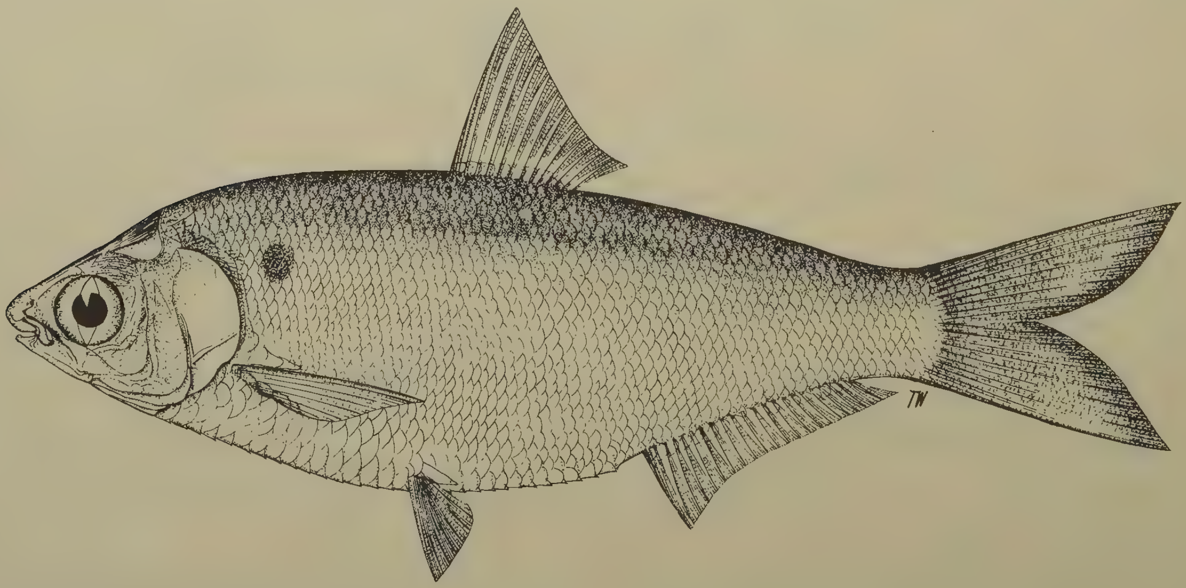
Gonialosa manmina (Hamilton-Buchanan, 1822)

CLUP Gon 1

Clupanodon manmina Hamilton-Buchanan, 1822, Fishes of Ganges:247 (Ganges).

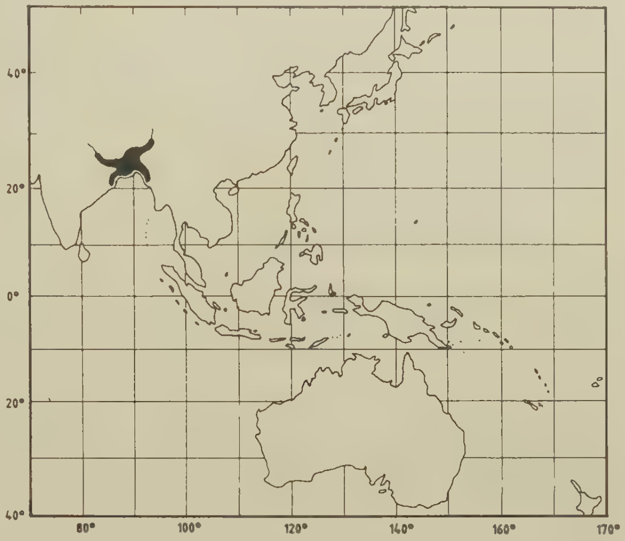
Synonyms : Clupanodon cortius Hamilton-Buchanan, 1822:249 (near Goyalpara, Bramaputra River); Gonialosa manmina - Regan, 1917:315 (India, Assam); Fowler, 1941:548 (misspelt manminna, compiled); Whitehead, 1962:101 (key); Idem, 1973b:206, fig. 32 (key, refs); Nelson & Rothman, 1973:147, fig. 4C (photo) (synon., descr., refs); Wongratana, 1980:186, pls 142, 143 (revision).

FAO Names : En - Ganges river gizzard shad.



Diagnostic Features : A riverine gizzard shad; body fairly deep, its depth 33 to 38% of standard length, somewhat compressed, belly with 16 to 20 (usually 17 or 18) + 11 to 14 (usually 11 to 13), total 27 to 33 (usually 29 to 31) scutes. Mouth inferior, upper jaw slender at tip and distinctly turned down, second supra-maxilla very small. Scales small, 51 to 71 in lateral series. Resembles G. modesta of Burmese rivers, which is much deeper (depth 41 to 45% of standard length) and has larger scales (44 to 50 in lateral series); G. whiteheadi of Burmese rivers is also deeper-bodied, and has a subterminal mouth. Anodontostoma species usually have only 19 to 21 anal finrays (usually 23 to 26 in G. manmina) and are deeper-bodied. Other clupeids in the Ganges system either have terminal mouths (Tenualosa, Gudusia, etc.) or a dorsal filament (Nematalosa).

Geographical Distribution : Rivers and associated waterbodies of Sri Lanka (fide Day, 1878:633 - see Remarks), India (Ganges and other rivers of Orissa, Uttar Pradesh, Bengal, Assam), Bangladesh; also Andaman Islands (fide Herre, 1940 - perhaps this was Anodontostoma selangkat).



Habitat and Biology : Riverine and in pools. More data needed.

Size : To 11.5 cm standard length.

Interest to Fisheries : Contributes to inland catches, but no major fishery reported.

Local Names : -

Literature : Nelson & Rothman (1973) give 31 references, many of them repetitive. There appears to be no published study on the biology of this species.

Remarks : Day (1878) seems to have been the only author to cite Sri Lanka (followed by Munro, 1955), but neither Nelson & Rothman (1973) nor Wongratana (1980) found specimens; Day also gave the Indus system, but again no specimens seem to be known. The Andaman record by Herre (1940) is perhaps doubtful too.

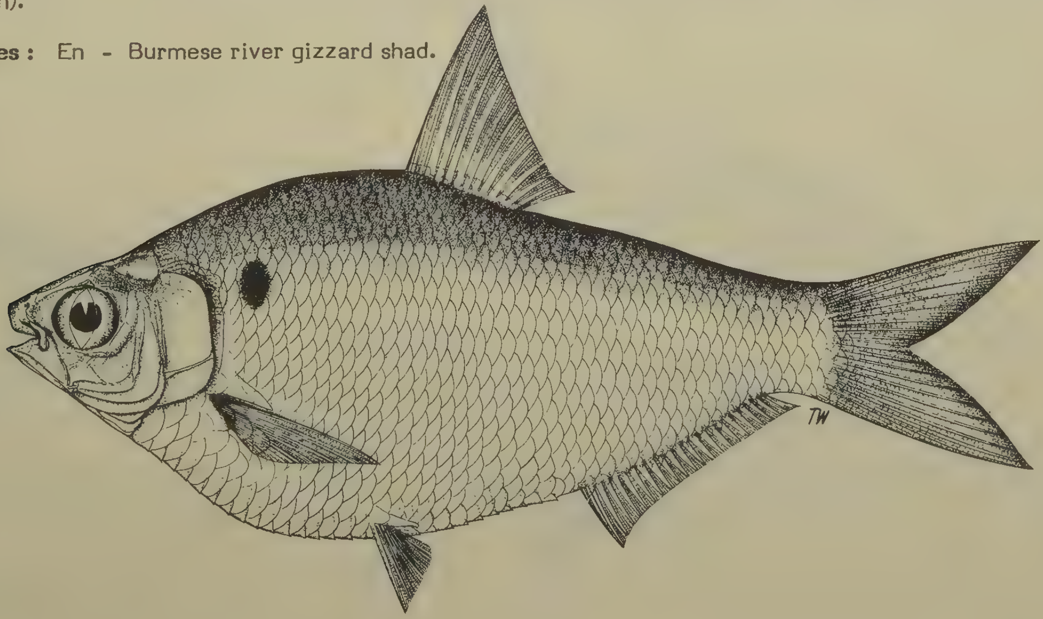
Gonialosa modesta (Day, 1869)

CLUP Gon 2

Chatoessus modestus Day, 1869, Proc.zool.Soc.Lond.:622 (Bassein River, Burma, as high as Een-gay-gyee Lake).

Synonyms : Gonialosa modesta - Fowler, 1941:548 (compiled); Regan, 1917:315 (Burma); Whitehead, 1962:101 (key); Idem, 1971:73, pl. 2a (Day's figure) (types of modesta); Nelson & Rothman, 1973:149, fig. 5A (photo) (synon., descr., refs); Whitehead & Talwar, 1976:155 (types of modesta listed); Wongratana, 1980:187, pls 144, 145 (revision).

FAO Names : En - Burmese river gizzard shad.



Diagnostic Features : A riverine gizzard shad; body very deep, its depth 40 to 45% of standard length, strongly compressed, belly with 16 to 19 (usually 17 or 18) + 10 to 12 (usually 11), total 27 to 30 (usually 29) scutes. Mouth inferior, upper jaw a little expanded at tip, but distinctly turned down, second supra-maxilla small (about half length of pre-maxilla). Scales moderate, 40 to 50 in lateral series. Resembles G. manmina of Indian rivers, which is much more slender (depth 33 to 38% of standard length) and has smaller scales (51 to 71 in lateral series); sympatric with G. whiteheadi, which has a subterminal mouth and a large second supra-maxilla (longer than pre-maxilla). Anodontostoma species usually have only 19 to 21 anal finrays (24 to 28 in G. modesta) and median instead of paired pre-dorsal scales. Other clupeids in Burmese freshwaters either have terminal mouths (Tenualosa, Gudusia, etc.), or a dorsal filament (Nematalosa).

Geographical Distribution : Rivers and associated waterbodies of Burma (Sittang River, Bassein River as high as Een-gay-gyee Lake, also Selwein River at Moulmein, south to Tenasserim River, but presumably also in the Irrawady).

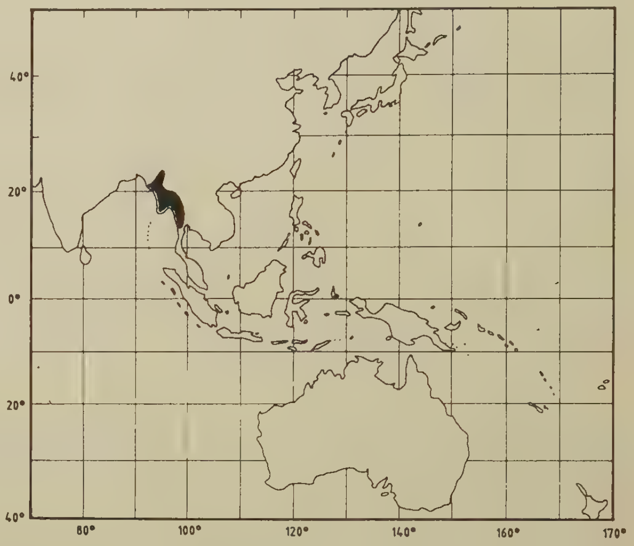
Habitat and Biology : Riverine and in pools and lakes. More data needed.

Size : To 10 cm standard length.

Interest to Fisheries : Contributes to inland catches, but no special fishery reported.

Local Names : -

Literature : Nelson & Rothman (1973) give 12 references, most of them repetitive. There appears to be no published study on the biology of this species.



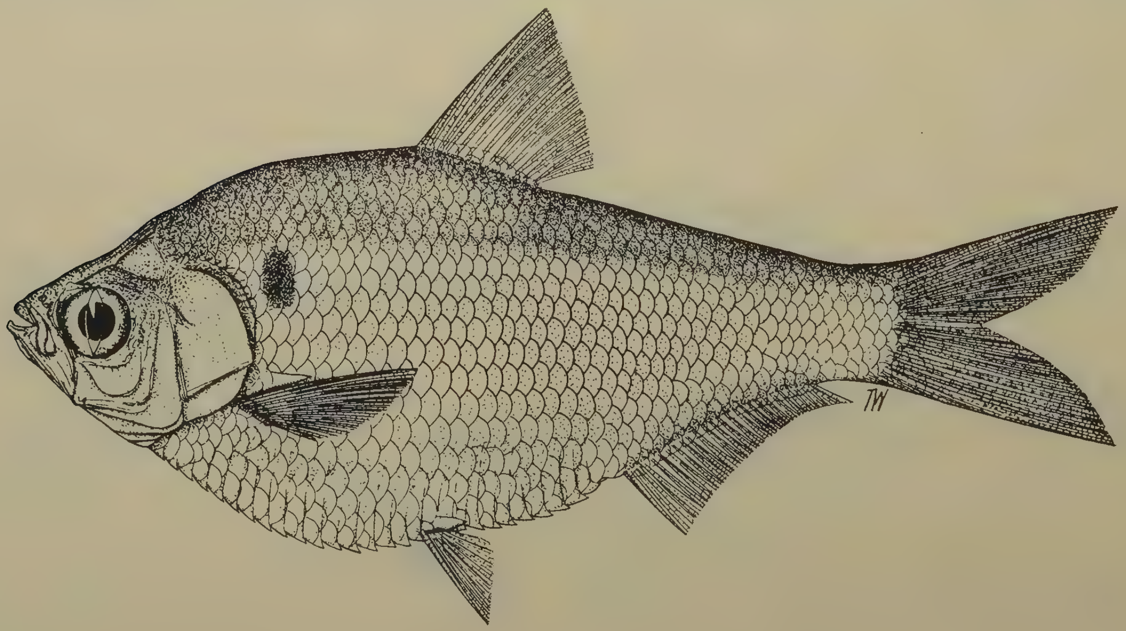
Gonialosa whiteheadi Wongratana, 1983

CLUP Gon 3

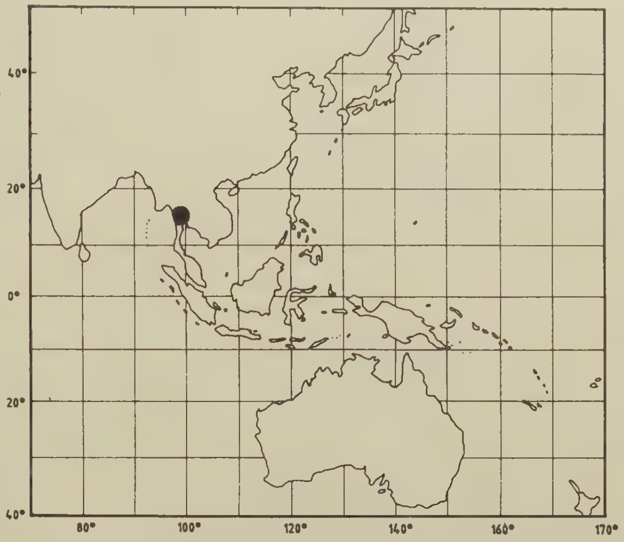
Gonialosa whiteheadi Wongratana, 1983, Jap.J.Ichthyol., 29(4):394, fig. 10 (Kokariet, Tenasserim River, Burma).

Synonyms : None.

FAO Names : En - Southern Burmese river gizzard shad.



Diagnostic Features : A riverine gizzard shad; body very deep, its depth at least 40% of standard length (44.6% at 6.8 cm in holotype), strongly compressed, belly with 17 + 10, total 27 scutes. Mouth subterminal, upper jaw expanded at tip, appearing to turn down, second supra-maxilla large (longer than pre-maxilla). Scales moderate, 43 in lateral series. Resembles G. modesta of Burmese rivers, which has an inferior mouth and a small second supra-maxilla (about half length of pre-maxilla); G. manmina of Indian rivers is much more slender (depth 33 to 38% of standard length) and has smaller scales (51 to 71 in lateral series). Anodontostoma species usually have only 19 to 21 anal finrays (27 in G. whiteheadi). Other clupeids in Burmese freshwaters either have terminal mouths (Tenualosa, Gudusia, etc.) or a dorsal filament (Nematalosa).



Geographical Distribution : Burma (Kokariet on Tenasserim River).

Habitat and Biology : Riverine. More specimens and data needed.

Size : To 6.8 cm standard length, perhaps more.

Interest to Fisheries : Not known.

Local Names : -

Literature : Probably misidentified as G. modesta

Remarks : Perhaps not uncommon in Burmese rivers, but at present known from a single specimen. It may well have been confused with G. modesta by fishery workers.

2.3 FAMILY PRISTIGASTERIDAE

PRIST

FAO Names : En - Pristigasterids.

Diagnostic Features : Moderate or sometimes quite large clupeoid fishes (usually to about 20 to 25 cm standard length, but some South American Pellona to about 50 cm). Body compressed, very deep in some (Pristigaster), more elongate in others; fully scuted along belly. The mouth is terminal or more often the lower jaw projects; there are 2 supra-maxillae, and the jaw teeth are small or minute (but canines in Chirocentrodon); a toothed hypo-maxillary bone present in some genera, joining the hind tip of the pre-maxilla to the blade of the maxilla. The dorsal fin is short, its origin before the midpoint of the body in very deep forms, but behind in elongate forms (or missing in Raconda); pectoral fins moderate or large in the elongate forms; pelvic fins small, with 6 or 7 finrays, but absent in some genera; anal fin long, with at least 30 finrays (60 or more in some species). The scales may be adherent or easily lost, of moderate size (about 35 to 55 in lateral series).

Until recently, the pristigasterines were considered a subfamily of the Clupeidae. Nelson (1967:392) found unique features in their gill arches (tooth plates fused to second basibranchial and to one or more pairs of hypobranchials, especially the second pair); he raised them to the rank of super-family. Grande (in press) did the same, adding two further distinctive characters: pre-dorsal bones either upright or inclined forward (inclined backward in all clupeids, except upright in Ramnogaster), and no gap between the second and third hypural bones of the tail (upper and lower caudal finrays separated by this gap in clupeids).

Biology, Habitat and Distribution : Pristigasterids are mostly marine coastal and schooling fishes of tropical and some subtropical seas. They are found on both sides of the Pacific and Atlantic Oceans and throughout the Indian ocean, from about 30°N (southern Japan) to about 30°S (South Africa). Some species enter estuaries and a few species in South America appear to be restricted to freshwater (Pellona).

Interest to Fisheries : No special fisheries exist for particular species and the catches for only three species are reported (Ilisha elongata, Ilisha africana and Pellona ditchela - 21 885 tons in 1983). Nevertheless, pristigasterids are common in tropical fish markets and probably make a useful contribution to clupeoid catches.

There are 9 genera (3 worldwide, 5 New World and 1 Indo-Pacific) and 33 species (16 New World, 1 West Africa, 16 Indo-Pacific).

Key to the Genera

A. WEST AFRICA .... **Ilisha**

B. NEW WORLD

1a. Toothed hypo-maxilla present (Fig. 1a)

2a. Pelvic fins present; Atlantic coasts and drainage .... **Pellona**

2b. No pelvic fins; Pacific coasts .. **Pliosteostoma**

1b. No toothed hypo-maxilla (Fig. 1b)

3a. Pelvic fins present, body elongate (if not, see 5b)

4a. Jaw teeth small or minute, absent at centre of upper jaw .... **Ilisha**

4b. Canine-like teeth in both jaws, also at centre of upper jaw (Fig. 2) .... **Chirocentrodon**

3b. No pelvic fins (or if present, then body very deep indeed, see 5b)

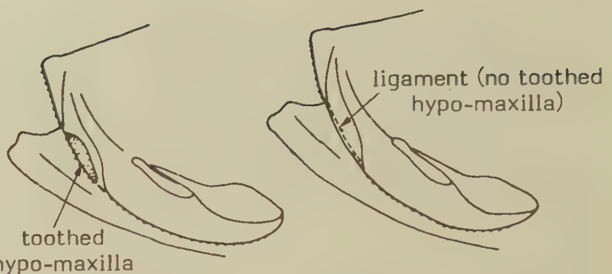
5a. Body elongate, depth up to 35% of standard length; dorsal fin origin behind midpoint of body

6a. Maxilla short, not reaching back beyond eye

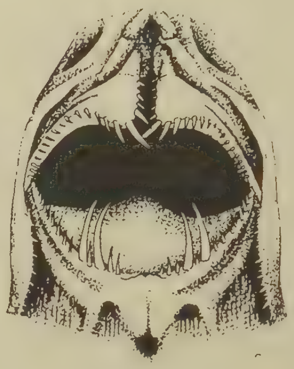
7a. Mouth terminal, jaws equal; hind tip of pre-maxilla meeting maxilla blade (Fig. 3a); anal finrays 50 or less; Atlantic and Pacific coasts........ **Neoopisthopterus**

7b. Lower jaw projecting, a distinct gap between hind tip of pre-maxilla and maxilla blade (Fig. 3b); anal finrays more than 50; Pacific coasts .... **Opisthopterus**

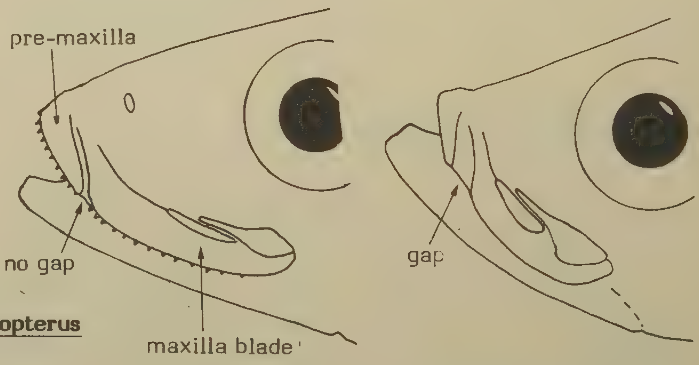
6b. Maxilla long, reaching to or beyond gill opening (Fig. 4); Atlantic and Pacific coasts .... **Odontognathus**



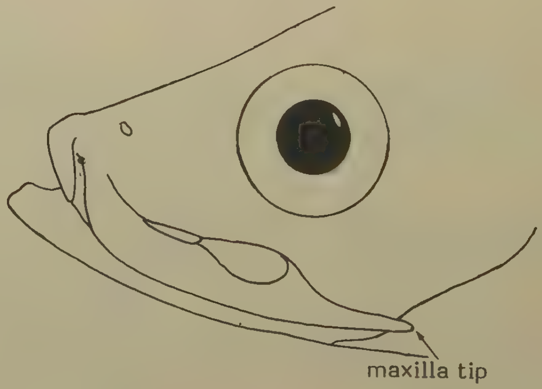
a) Pellona b) Ilisha Fig. 1



Chirocentrodon Fig. 2

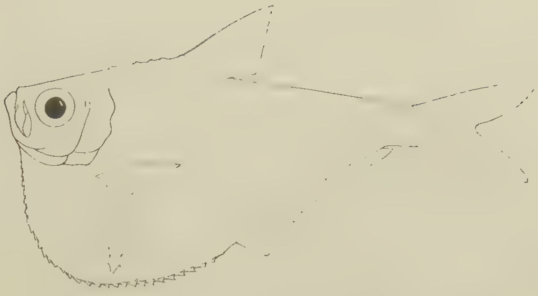


a. Neoopisthopterus b. Opisthopterus Fig. 3



Odontognathus Fig. 4

5b. Body very deep, depth about 50% of standard length (Fig. 5); dorsal fin origin before midpoint of body; small pelvic fins sometimes present; freshwater .... **Pristigaster**



Pristigaster Fig. 5

C. INDO-PACIFIC

1a. Toothed hypo-maxilla present (Fig. 1a) .... **Pellona**

1b. No toothed hypo-maxilla (Fig. 1b)

- 2a. Dorsal fin present
    - 3a. Anal fin moderate, 34 to 53 finrays; pelvic fins present .... **Ilisha**
    - 3b. Anal fin long, 51 to 65 finrays; no pelvic fins .... **Opisthopterus**
- 2b. No dorsal fin; no pelvic fins; anal fin very long, 81 to 92 finrays .... **Raconda**

Ilisha Richardson, 1846

PRIST Ilish

Formerly CLUP Ilish

Ilisha Richardson, 1846, Ichthyol.Seas China Japan:306 (type: Ilisha abnormis Richardson = Alosa elongata Bennett). Platygaster Swainson, 1838, Nat.Hist.Fishes, 1:278 (type: Clupea africana Bloch, 1795) (preoccupied in Hymenoptera). Zunasia Jordan & Metz, 1913, Mem.Carnegie Mus., 6(1):7 (type: Pristigaster chinensis Basilewski = Alosa elongata Bennett). Pseudochirocentrodon Miranda-Ribeiro, 1923, Publçoes Linhas Telegr.estrat. Matto Grosso Amazonas, (58):8 (type: Pseudochirocentrodon amazonicum Miranda-Ribeiro). Euplatygaster Fowler, 1934, Proc.Acad.nat.Sci.Philad., **85**:246 (type: Pellona brachysoma Bleeker = Clupea melastoma Schneider).

Diagnostic Features : Moderate-sized marine, estuarine or freshwater clupeoid fishes (to about 40 cm standard length), body moderately deep in some, elongate in others, compressed, with a sharp keel of scutes along belly. Eye usually large; lower jaw projecting, mouth directed obliquely upward; upper jaw reaching at most to eye centre; no toothed hypo-maxilla between hind tip of pre-maxilla and blade of maxilla; jaw teeth small or minute, usually with a distinct gap at centre or upper jaw. Gillrakers fairly short and thick, few, 17 to 28 on lower arch. Dorsal fin before or behind midpoint of body; pelvic fins present, small, with 6 or 7 finrays, a little or well in front of dorsal fin origin; anal fin moderately long, with 34 to 53 finrays, its origin under or a little behind dorsal fin base. Scales moderate, about 38 to 56 in lateral series. No distinctive colour patterns. The lack of a toothed hypo-maxilla distinguishes Ilisha from the otherwise similar Pellona.

Biology, Habitat and Distribution : Marine, pelagic, inshore, probably schooling, some or most species entering bays and estuaries and presumably able to tolerate at least a slight lowering of salinity, but a few appear to be purely freshwater species. Worldwide in tropical and subtropical waters, occurring throughout the Indo-West Pacific, off West Africa, and off Atlantic and Pacific coasts of central and South America

Interest to Fisheries : Only two species are individually reported: Ilisha elongata off coasts of China and Korea (in 1983 the catch was 15 338 tons) and Ilisha africana off West African coasts (4005 tons in 1983). Other species contribute to general clupeoid catches, chiefly by artisanal gear.

Species : The 11 Indo-West Pacific species were revised by Wongratana (1980), the literature for the single West African species is reviewed in CLOFETA, but more work is needed on the 2 New World species.

Indo-West Pacific

I. elongata (Bennett, 1830), Madras to southern Japan
I. filigera (Valenciennes, 1847), Bombay to Sarawak
I. kampeni (Weber & de Beaufort, 1913), Bay of Bengal to Indonesia
I. macrogaster Bleeker, 1866, Indonesia
I. megaloptera (Swainson, 1839), Bombay to Java Sea
I. melastoma (Schneider, 1801), India to Indonesia and Taiwan Island
I. novacula (Valenciennes, 1847), Rivers of Burma
I. obfuscata Wongratana, 1983, India
I. pristigastroides (Bleeker, 1852), Indonesia
I. sirishai Seshagiri Rao, 1975, the "Gulf" to Thailand
I. striatula Wongratana, 1983, Arabian Sea to northern Australia.

West Africa

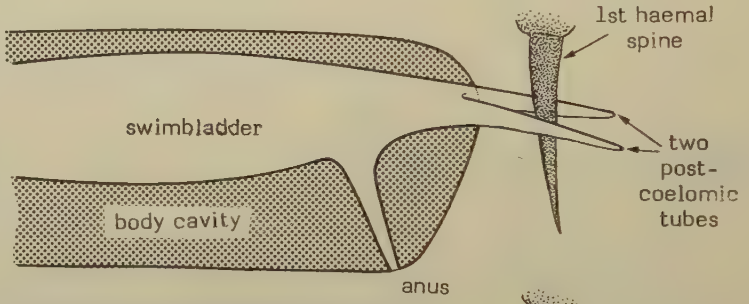
I. africana (Bloch, 1795), Senegal to Angola.

New World

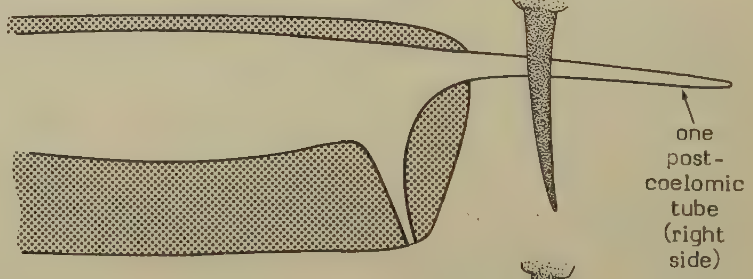
I. amazonica (Miranda-Ribeiro, 1923), Atlantic drainage (Amazon of Brazil, Peru)
I. furthii (Steindachner, 1875) Pacific coasts and drainage.

Remarks : Many of the Indo-Pacific species were seriously confused until fundamental differences in the swimbladder were found between superficially very similar species (Seshagiri Rao, 1974, 1976; Ramaiyan & Whitehead, 1975; Ramaiyan & Natarajan, 1979; most completely by Wongratana, 1980). Three types of swimbladder occur:

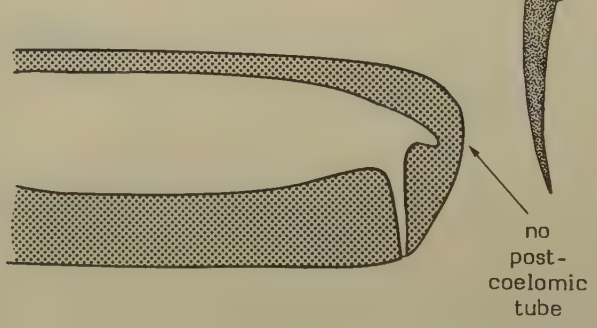
A. Two slender tubes from hind end of swimbladder passing back into the muscles on either side of the haemal spines (I. kampeni, I. melastoma, I. obfuscata, I. striatula; also I. africana of West Africa).



B. A single long tube from hind end of swimbladder passing back through muscles of right side of body (I. elongata, I. filigera, I. macrogaster, I. megaloptera, I. pristigastroides).



C. No tube or a very short one at hind end of swimbladder, not passing back into muscles (I. novacula, I. sirishai; this is also the condition in Pellona species).



This character is included in the diagnoses, but where possible other diagnostic features are also used to separate the species.

Ilisha africana (Bloch, 1795)

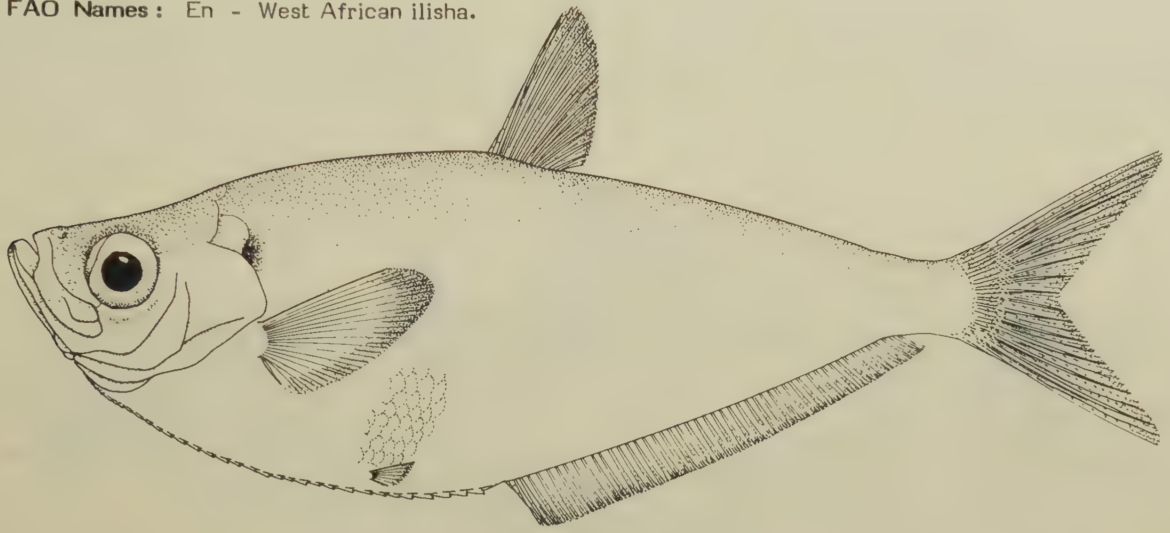
PRIST Ilish 5

Formerly CLUP Ilish 5

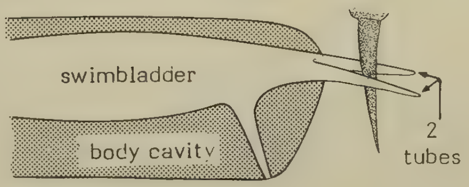
Clupea africana Bloch, 1795, Naturgesch.Ausl.Fische, 9:45, pl. 407 (Accra, Ghana).

Synonyms : Pellona iserti Valenciennes, 1847:307 (Accra); Pellona gabonica Duméril, 1861:259, pl. 23, figs 3, 3a (Gabon); Pristigaster dolloi Boulenger, 1902:271, pl. 30, fig. 3 (Banana, Congo); Ilisha melanota Derscheid, 1924:278 (Congo mouth); Irvine, 1947:111 (Accra); Ilisha africana - Fowler, 1936:78, fig. 71 (Congo mouth; synon., descr.); Whitehead, 1967:112 (types of iserti, gabonica, dolloi, melanota); Idem, 1969:268 (type of africana); CLOFETA in press (complete synon.).

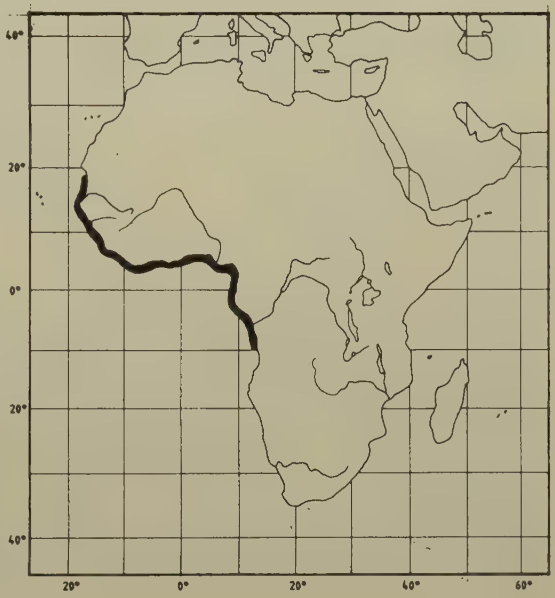
FAO Names : En - West African ilisha.



Diagnostic Features : Body moderately deep, compressed, belly with 25 to 27 + 7 or 8 sharp scutes. Eye large, lower jaw projecting. Dorsal fin at or before midpoint of body; pelvic fins small; anal fin long, with more than 40 finrays, its origin below dorsal fin base. Swimbladder with two short tubes passing back in the muscles on either side of haemal spines. Other clupeoid fishes in the area are more slender, have a much shorter anal fin and the lower jaw not strongly projecting. See CLUP Ilish 5, Fishing Areas 34, 47 (part).



Geographical Distribution : West African coasts and estuaries (northern parts of Senegal south to Baie de Saint-Bras, Angola, at $10^{o}S$).



Habitat and Biology : Marine, pelagic, along beaches and just off shore, down to about 25 m, also in lagoons and estuaries, penetrating into almost freshwater. Feeds on small planktonic animals (crustaceans, etc.).

Size : To 20 cm standard length, usually about 12 to 16 cm.

Interest to Fisheries : No special fishery, but contributes to clupeoid fisheries (about 400 tons marketed at Abidjan in some years). Mainly caught by trawl, but also in purse-seine. The total catch in 1983 was 4005 tons.

Local Names : ANGOLA: Fanhico (Portuguese); DAHOMEY: Afléma (Fon), Kaflan (at Grand Popo), Kaflanvi (at Cotonou); GHANA: Kanfla and variants (Fante), also Tamtemire (Fante); GUINEA: Lati (Soussous); IVORY COAST: Lala (Lake Ebrié), Nafran (Appolonien), Pétênana juaba (Brignan); SENEGAL: Rimbal (Ovolof), Tialimaro (Mandique).

Literature : Whitehead (i.e. CLOFETA, in press) gave 61 references up to 1981 covering taxonomic, biological and fishery literature.

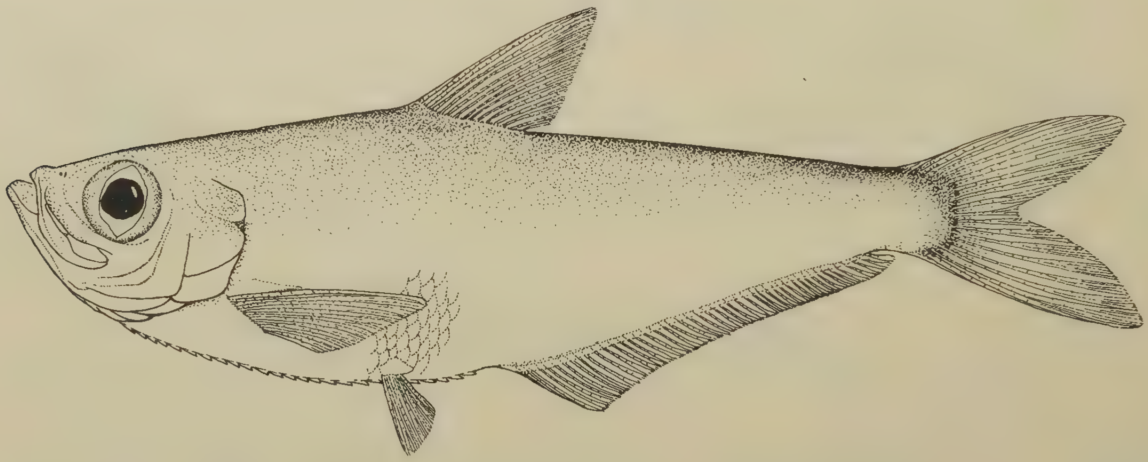
Ilisha amazonica (Miranda-Ribeiro, 1923)

PRIST Ilish 14

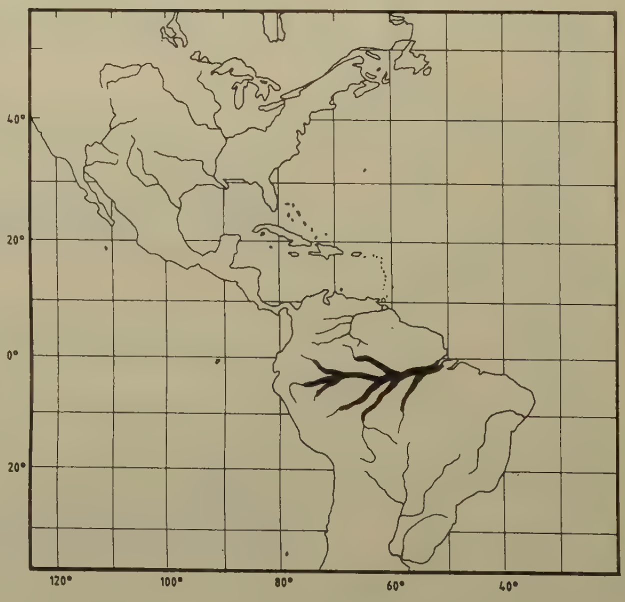
Pseudochirocentrodon amazonicum Miranda-Ribeiro, 1923, Publçoes Linhas Telegr.estrat.Matto Grosso Amazonas, (58):8 (Manáos, Amazon).

Synonyms : Ilisha iquitensis Nakashima, 1941:66, fig. (near Iquitos, Peruvian Amazon); Ilisha apapae Hildebrand, 1948:3, fig. 2 (Amazon, between Manáos and Pará); Ilisha amazonica - Myers, 1950:63 (types of amazonicum, apapae, synon.); FWNA, 1964:421, fig. 105 (synopsis); Whitehead, 1970:21 (key only).

FAO Names : En - Amazon ilisha.



Diagnostic Features : Body moderately elongate, compressed, belly with 25 or 26 scutes. Eye large, lower jaw projecting; gap between hind tip of pre-maxilla and blade of maxilla a ligament, not a toothed bone; lower gillrakers 17 to 22. Dorsal fin origin well before midpoint of body; pelvic fins present; anal fin long, with 47 to 52 finrays. Resembles species of Pellona, which have a distinct toothed hypo-maxilla between the hind tip of the pre-maxilla and the blade of the maxilla. Other similar clupeoids are either much deeper-bodied (Pristigaster, depth about 50% of standard length), or lack pelvic fins (Odontognathus, Opisthopterus, Neoopisthopterus) or have canine teeth (Chirocentrodon).



Geographical Distribution : Amazon (from Pará and Manáos up to Iquitos in Peru).

Habitat and Biology : Riverine, apparently not entering sea. More specimens and data needed.

Size : To 17.3 cm standard length.

Interest to Fisheries : No data. The paucity of museum specimens may not reflect an actual rarity of the fish.

Local Names : BRAZIL: Apapa, Asuna nahui.

Literature : Hildebrand (i.e. FWNA, 1964 - descr., range).

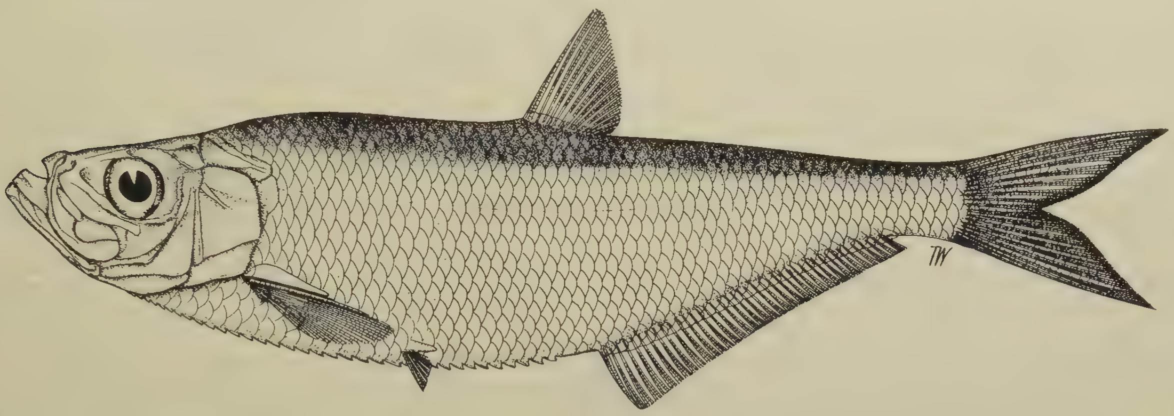
Ilisha elongata (Bennett, 1830)

PRIST Ilish 2

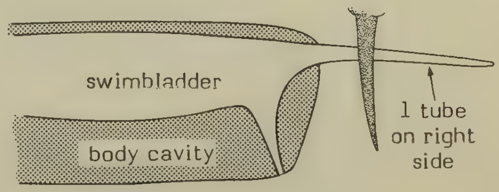
Alosa elongata Bennett, 1830, Mem.Life of Raffles:691 (Sumatra) (exact date not known, presumed before July).

Synonyms : Clupea affinis Gray, 1830 (15 July):pl. 96, fig. 2 (India, on Hardwicke drawing; dating by Sawyer, 1953); Ilisha abnormis Richardson, 1846:306 (Macao or Canton); Pellona leschenaulti Valenciennes, 1847:311 (Pondicherry); Pellona grayana Valenciennes, 1847:315 (on Clupea affinis Gray); Pellona vimbella Valenciennes, 1847:317 (Macao); Pellona schlegelii Bleeker, 1854:418 (Nagasaki); Pristigaster chinensis Basilewski, 1855:243 (Gulf of Tschiliensi, China); Pristigaster (Pristigaster) sinensis Sauvage, 1881:107 (Swatow); Ilisha elongata - Fowler, 1941:661 (Bombay ?; Jakarta, Hong Kong, Korea, Japan; large synon.); Svetovidov, 1952:321, pl. 26, fig. 2 (Peter the Great Bay, 1914 to 1938); Idem, 1963:361, pl. 26, fig. 2 (same); Chu, Tchang & Chen, 1963:104, fig. 79 (China); Whitehead, 1966:32, pl. 3, fig. 2 (Reeves drawing) (type of abnormis); Idem, 1967:118, 119, 120, 121 (types of leschenaulti, grayana, vimbella); Idem, 1973b:211, fig. 36 (key, synon.); Ramaiyan & Whitehead, 1975:195 (key, descr.); Wongratana, 1980:204, pls 165, 166 (revision); Masuda et al., 1984:20, pl. 22D (colour photo) (southern Japan); Whitehead & Bauchot, in press (types of Valenciennes species).

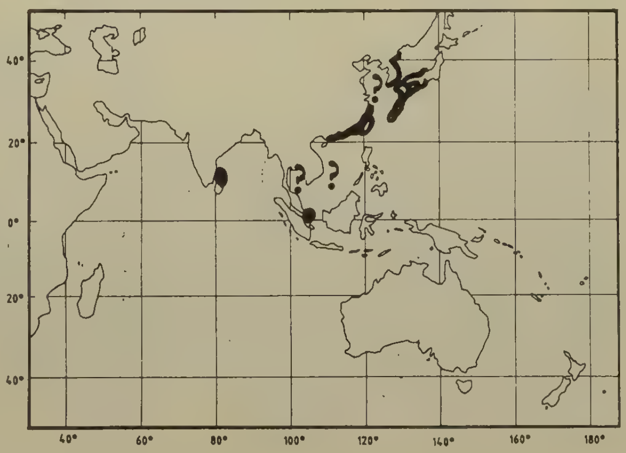
FAO Names : En - Elongate ilisha.



Diagnostic Features : Body slender, its depth 27 to 31% of standard length, belly with usually 24 to 25 + 10 to 15, total 34 to 42 scutes. Eye large, lower jaw projecting; lower gillrakers 19 to 25. Dorsal fin origin at about midpoint of body or a little behind; anal fin with 43 to 53 finrays, its origina a little behind dorsal fin base. Swimbladder with a single long tube passing back down right side of body above anal fin base. Resembles I. megaloptera, I. filigera, I. macrogaster and I. pristigastroides in this swimbladder character, but these are either deeper-bodied (depth 31 to 36%) or have only 28 to 35 scutes (I. megaloptera). Other Ilisha species have either twin tubes from the hind end of the swimbladder (and usually only 25 to 30 scutes) or no posterior tubes (and more or fewer scutes). Pellona species are deeper-bodied and have a distinct toothed hypo-maxilla. See CLUP Ilish 2, Fishing Areas 57, 71.



Geographical Distribution : Indian Ocean (Pondicherry, based solely on the type of Pellona leschenaulti; no other confirmed Indian records), Java Sea (Singapore), East China Sea (Canton north to the Koreas and southern Japan, as far as Osaka on the Pacific coast and Fukuoka in Sea of Japan, also Peter the Great Bay in Soviet waters).



Habitat and Biology : Marine, pelagic and inshore, entering estuaries and presumably able to tolerate lowered salinities. A warm-water species that does not reach the northern part of its range in cool years.

Size : To 40.5 cm standard length.

Interest to Fisheries : The only Indo-Pacific species of Ilisha for which individual statistics are reported. In 1983 the catch was 15 338 tons from China and the Koreas.

Local Names : -

Literature : See under Synonyms.

Remarks : The westward extension of the range of I. elongata to India is based on a single specimen (see above). However, before the differences in swimbladder form were noted and used to separate the species by Ramaiyan & Whitehead (1975), Indian specimens of Ilisha may have been reported under other names.

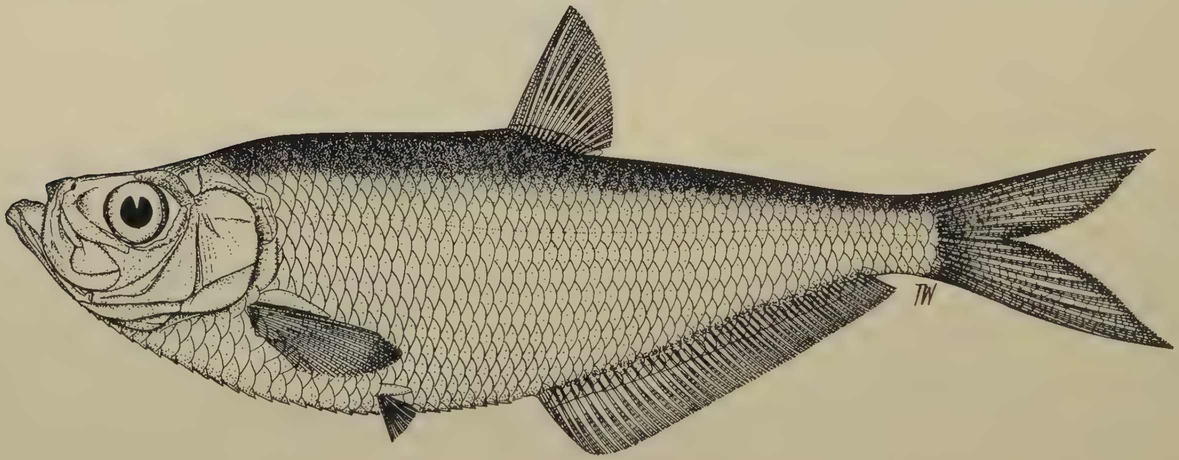
Ilisha filigera (Valenciennes, 1847)

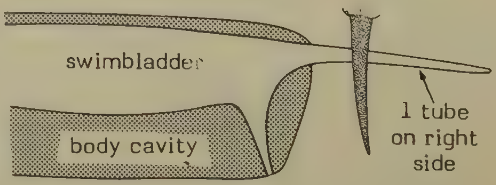
PRIST Ilish 6

Pellona filigera Valenciennes, 1847, Hist.nat.poiss., **20**:322 (Bombay, Coromandel coast) (in part, the other specimen being Ilisha obfuscata).

Synonyms : Pellona xanthoptera Bleeker, 1851:439 (Sambas, Kalimantan, Indonesia); Weber & de Beaufort, 1913:94 (Java, Kalimantan); Ilisha xanthoptera:Fowler, 1941:658 (compiled); Whitehead et al., 1966:96, pl. 12, fig. 1 (Bleeker's fig.) (types of xanthoptera); Ilisha filigera - Fowler, 1941:658 (compiled); Whitehead, 1967:117 (types of filigera); Idem, 1973b:213 (in synon. of I. megaloptera); Wongratana, 1980:206, pls 167, 168 (revision); Bauchot & Whitehead, in press (types of filigera).

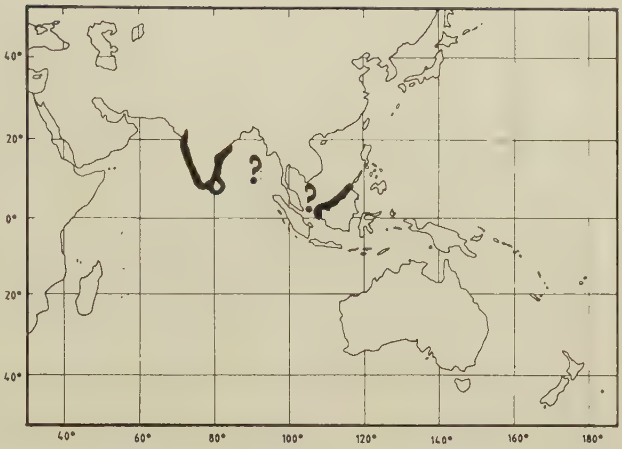
FAO Names : En - Coromandel ilisha.





Diagnostic Features : Body moderately slender, its depth 31 to 35% of standard length, belly with 23 to 26 + 11 to 13, total 34 to 38 scutes. Eye large, lower jaw projecting; lower gillrakers 19 to 23. Dorsal fin origin at about midpoint of body or a little behind; anal fin with 46 to 52 finrays, its origin below dorsal fin base. Swimbladder with a single long tube passing back down right side of body above anal fin base. Resembles four other Indo-Pacific species of Ilisha in this swimbladder character, but these have fewer scutes (I. megaloptera), fewer gillrakers (I. pristigastroides), or more gillrakers (I. macrogaster), or are more slender (I. elongata). Other Ilisha species have either twin tubes from the hind end of the swimbladder (and usually only 25 to 30 scutes) or no posterior tubes (and fewer scutes or a more slender body). Pellona species have a distinct toothed hypo-maxilla.

Geographical Distribution : Indian Ocean (Bombay to eastern coasts of India; perhaps east to Andaman Sea coasts, but no certain records), South China Sea (northwestern coasts of Kalimantan, also Sarawak).



Habitat and Biology : Marine, pelagic and coastal, apparently entering estuaries (Weber & de Beaufort, 1913 - as Pellona xanthoptera). More data needed, based on better identifications than in the past.

Size : To 22 cm standard length, perhaps more.

Interest to Fisheries : Contributes to artisanal catches of clupeoids, but no special fishery.

Local Names : INDIA: Phansa (Calcutta, but probably the same name used for other species of Ilisha).

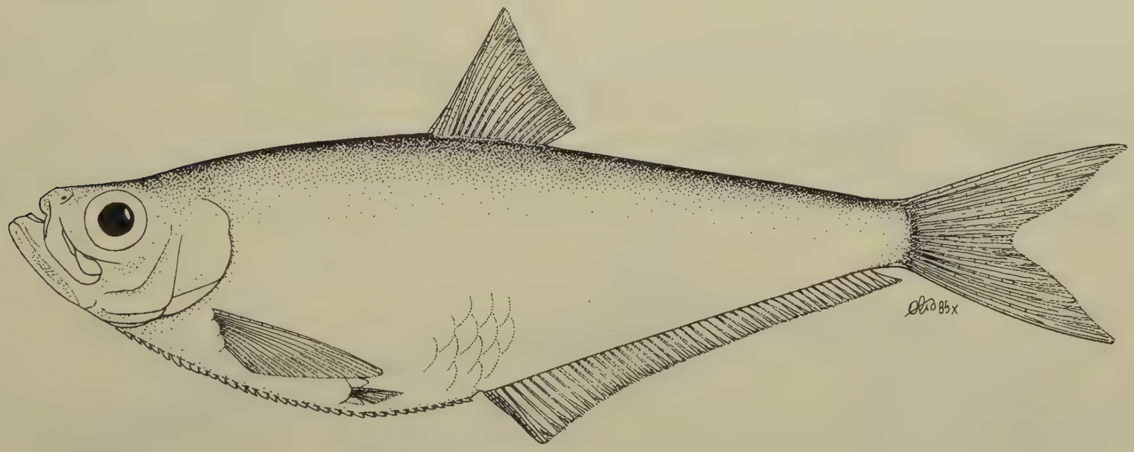
Ilisha furthii (Steindachner, 1875)

PRIST Ilish 7

Pellona furthii Steindachner, 1875, Sber.Akad.Wiss.Wien, **70**:388 (Bay of Panama); Idem, 1875:Ichthyol. Beitr., (1):14 (repeat).

Synonyms : Pellona panamensis Steindachner, 1875:389, (Panama); Idem, 1875:15 (repeat); Meek & Hildebrand, 1923:189 (brackishwater at Corozal and from Panama market); Hildebrand, 1946:91 (off Puerto Pizarro and mouth of Tumbes River, Gulf of Guayaquil, Peru; also Guayaquil, Ecuador); Peterson, 1956:180 (Chira Island and Barranca Bay, Gulf of Nicoya, Costa Rica); Cobo & Massay, 1969:7 (Ecuador - listed).

FAO Names : En - Pacific ilisha.



Diagnostic Features : Body moderately slender, compressed, belly with 23 to 25 + 11 to 14 scutes. Eye large, lower jaw projecting; gap between hind tip of pre-maxilla and blade of maxilla a ligament, not a toothed bone; lower gillrakers 20 to 25. Dorsal fin origin a little before midpoint of body; anal fin long, with 46 to 50 finrays, its origin below about last dorsal finrays. Other similar clupeoids in the area have no pelvic fins (Pliosteostoma, which has a toothed hypo-maxilla between pre-maxilla tip and blade of maxilla; Odontognathus, which has a long maxilla reaching back beyond eye; Neoopisthopterus, which like the others is much more elongate).

Geographical Distribution : Eastern central Pacific (Costa Rica in Gulf of Nicoya to Panama and south to Gulf of Guayaquil).

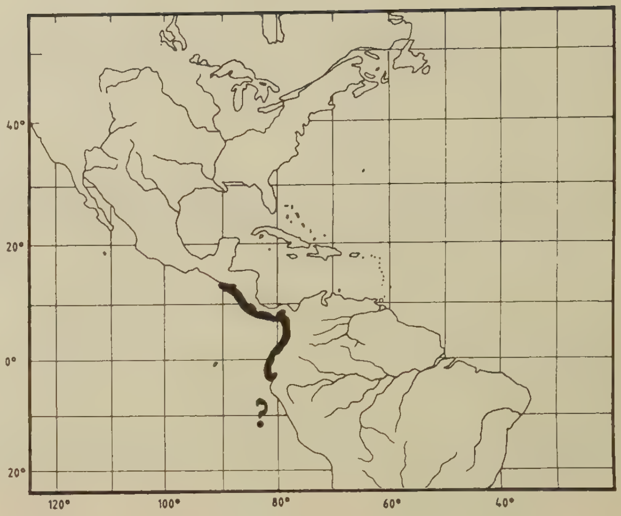
Habitat and Biology : Marine, coastal, but entering estuaries and other brackishwater, perhaps to spawn there.

Size : To 28.5 cm standard length.

Interest to Fisheries : Enters markets (e.g. at Panama) and is apparently a common food fish.

Local Names : ECUADOR, PERU: Machete.

Literature : Peterson (1956 - notes on maturity and ecology).



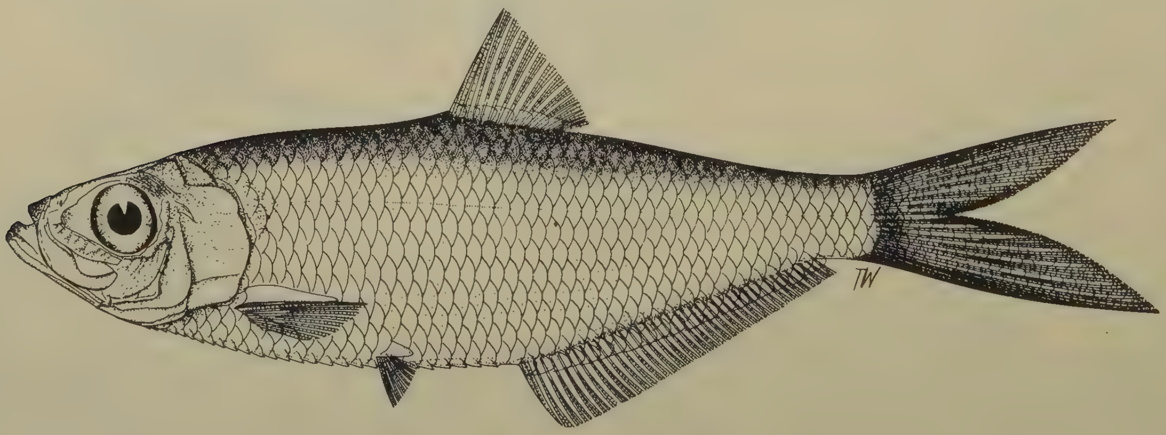
Ilisha kampeni (Weber & de Beaufort, 1913)

PRIST Ilish 8

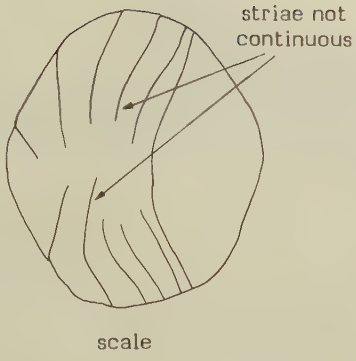
Pellona kampeni Weber & de Beaufort, 1913, Fishes Indo-Australian Arch., **2**:87 (Jakarta, Java and Balikpapan, Kalimantan).

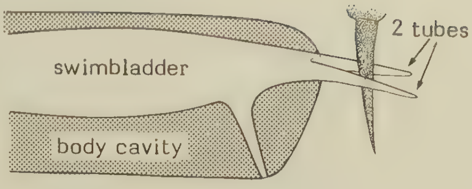
Synonyms : Ilisha whiteheadi Seshagiri Rao, 1974:861, figs 1-3 (Kakinada, Bay of Bengal); Ilisha kampeni - Fowler, 1941:654 (compiled); Ramaiyan & Whitehead, 1975:196, fig. 2a-e (key, descr., swimbladder; Kakinada, Porto Novo); Wongratana, 1980:208, pls 171, 172 (revision).

FAO Names : En - Kampen's ilisha.

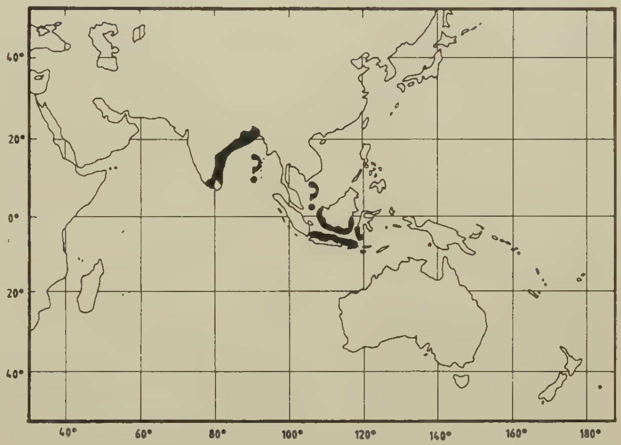


Diagnostic Features : Body moderately slender, its depth 24 to 32% of standard length, belly with usually 19 to 21 - 8, total 27 to 29 scutes. Eye large, lower jaw projecting; lower gillrakers 20 to 24. Dorsal fin origin at about midpoint of body; anal fin with 38 to 46 finrays, its origin under hind part of dorsal fin base. Vertical striae on scales not continuous, but with a distinct gap across centre of scale. Swimbladder with two tubes passing back in the muscles on either side of haemal spines. Resembles three other Indo-Pacific species of *Ilisha* in this swimbladder character, but these have more gillrakers (*I. obfuscata*), scale striae that traverse the scale, also body deeper (*I. melastoma*) or are deeper and have longer pectoral fins (*I. striatula*; pectoral fin 18 to 21% of standard length, cf. 15 to 17%). Other *Ilisha* species have either a single long tube from the hind end of the swimbladder (and more scutes), or no posterior tubes (and a deeper body or more scutes). *Pellona* species have a distinct toothed hypo-maxilla.





Geographical Distribution : Indian Ocean (eastern coasts of India north to Calcutta), Indonesia (Jakarta, Java; also Kalimantan at Kotabaru, Takisung on southeastern coast and at Aluhaluh on Barito River). Records of this species from the Arabian Sea (Seshagiri Rao, 1975) need confirmation.



Habitat and Biology : Marine, pelagic, coastal, but also entering rivers and tolerating water of low salinity. Feeds on planktonic crustaceans and fishes, also amphipods.

Size : To 15 cm standard length, perhaps more.

Interest to Fisheries : Contributes to artisanal clupeoid catches, but no special fishery. Caught by cast nets in the Vellar estuary, Porto Novo, India.

Local Names : -

Literature : Ramaiyan & Whitehead (1975 - brief notes on distribution and biology).

Remarks : Long regarded as an Indonesian species, its presence off Indian coasts was unsuspected until reported by Ramaiyan & Whitehead (1975) and the revision by Wongratana (1980). An apparently distinct but closely related species from the Arafura and Timor Seas, Gulf of Carpentera and off Papua New Guinea will be described by Dr Patricia Kailola. It differs from *I. kampeni* chiefly in having the striae continuous across the scale, slightly more pyloric caeca (19 to 24; cf. 15 to 19), fewer gillrakers (18 to 20; cf. 20 to 24) and more vertebrae (43 to 45; cf. 41 or 42).

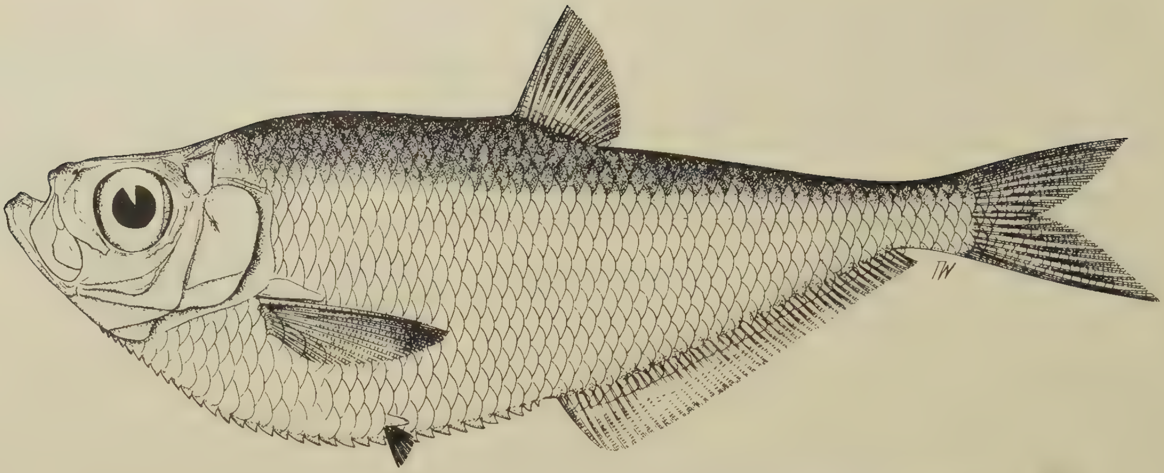
Ilisha macrogaster Bleeker, 1866

PRIST Ilish 9

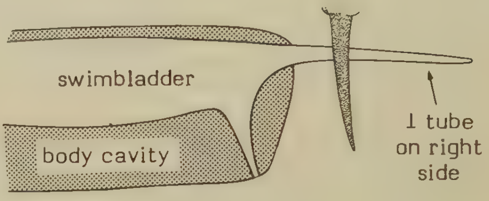
Ilisha macrogaster Bleeker, 1886, *Ned.Tijdschr.Dierk.*, 3:300 (Sambas, Kalimantan, Indonesia).

Synonyms : *Pellona macrogaster*:Weber & de Beaufort, 1913:93 (on Bleeker); *Ilisha macrogaster* - Fowler, 1941:660 (compiled); Whitehead *et al.*, 1966:98, pl. 12, fig. 2 (Bleeker's fig.) (type of *macrogaster*); Whitehead, 1973b:211 (key only); Wongratana, 1980:207, pl. 169 (revision).

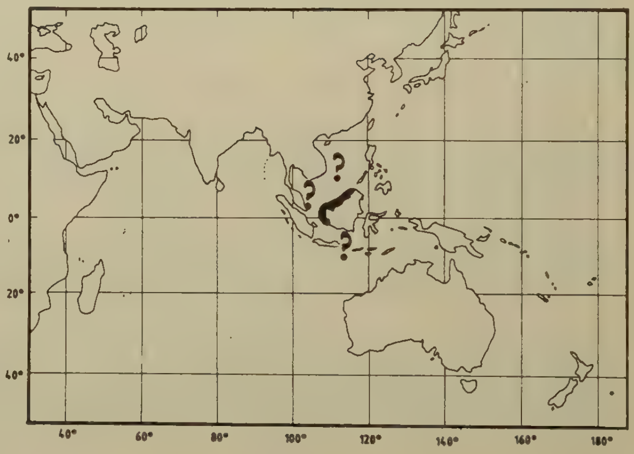
FAO Names : En - Kalimantan ilisha.



Diagnostic Features : Body moderately deep, its depth 34 to 36% of standard length, belly with 25 + 11, total 36 scutes. Eye large, lower jaw projecting; lower gillrakers 23 to 25. Dorsal fin origin at about midpoint of body; anal fin with 49 finrays, its origin under dorsal fin base. Swimbladder with a single long tube passing back down right side of body above anal fin base. Resembles four other Indo-Pacific species of Ilisha in this swimbladder character, but these are more slender (I. elongata, I. pristigastroides), have fewer scutes and gillrakers (I. megaloptera) or fewer gillrakers (I. filigera). Other Ilisha species have either twin tubes from the hind end of the swimbladder (and usually only 25 to 30 scutes) or no posterior tubes (and fewer scutes or fewer gillrakers). Pellona species have a distinct toothed hypo-maxilla.



Geographical Distribution : South China Sea (western Kalimantan, Sarawak).



Habitat and Biology : Marine, pelagic and coastal, perhaps entering estuaries. More data needed.

Size : To 12 cm standard length.

Interest to Fisheries : No data.

Local Names : -

Literature : See under Synonyms.

Remarks : Wongratana (1980) was able to examine only two specimens; more material may show that this species is merely I. filigera.

Ilisha megaloptera (Swainson, 1839)

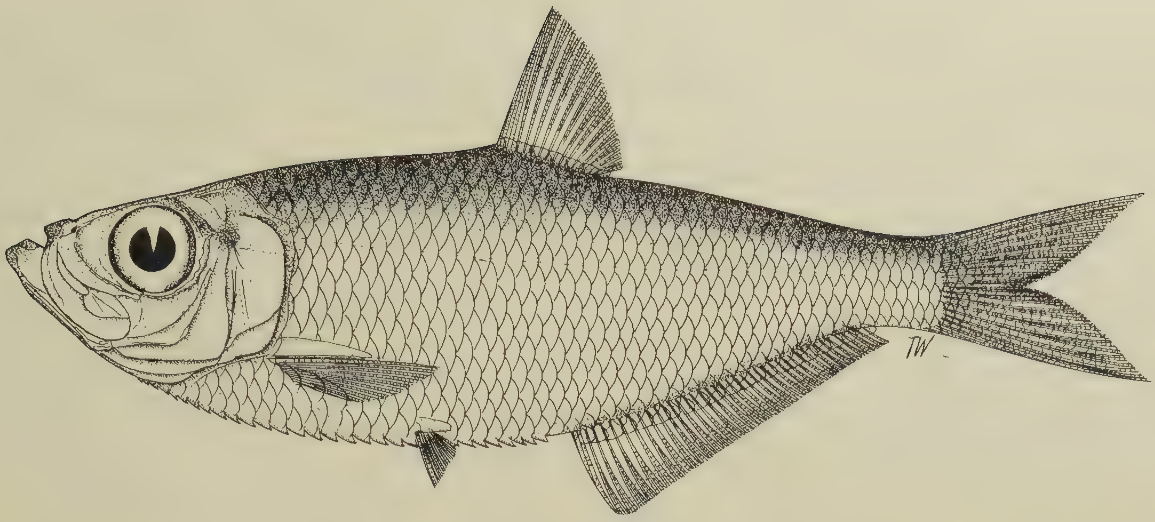
PRIST Ilish 4

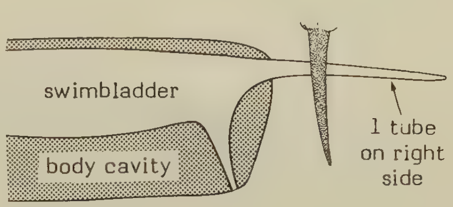
Formerly CLUP Ilish 4

Platygaster megalopterus Swainson, 1839, Nat.Hist.Anim., 2:294 (on Jangarloo of Russell, 1803).

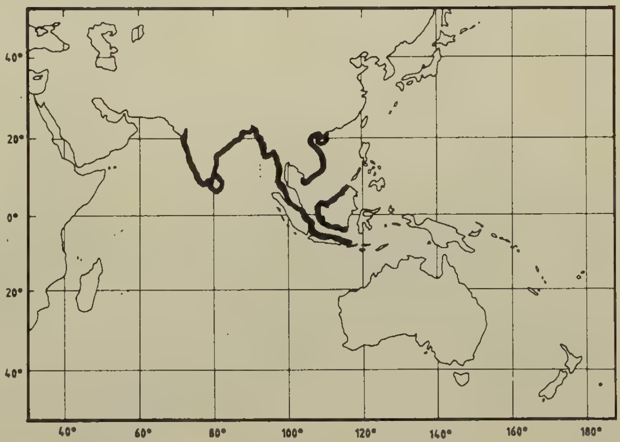
Synonyms : ? Clupanodon motius Hamilton-Buchanan, 1822:251 (Brahmaputra; nomen dubium); Platygaster macrophthalma Swainson, 1838:278 (on Jangarloo of Russell, 1803; nomen oblitum); ? Platygaster parva Swainson, 1839:294 (on Clupea motius of Gray, 1834); Pellona dussumieri Valenciennes, 1847:316, pl. 516 (Bombay, Malabar, Coromandel); Pellona russellii Bleeker, 1852:72 (Java, Madura, Pasuruan, Singapore); ? Ilisha melastoma:Fowler, 1941:659 (Kalimantan; megaloptera in synon.); Ilisha megaloptera - Whitehead, 1967:113, pl. 7c (Valenciennes figure) (type of dussumieri; macrophthalma rejected); Idem, 1973b:213, fig. 38 (key, synon., descr.; filigera, xanthoptera, russellii wrongly included); Ramaiyan & Whitehead, 1975:191, fig. 1d (key, descr.; Bombay to Singapore, Sarawak to Macao); Wongratana, 1980:201, pls 163, 164 (revision); Whitehead & Bauchot, in press (type of dussumieri).

FAO Names : En - Bigeye ilisha.





Diagnostic Features : Body rather deep, its depth 28 to 39% of standard length, belly with 19 to 23 + 8 to 12, total 28 to 35 (usually 30 to 34) scutes. Eye large, lower jaw strongly projecting; lower gillrakers 18 to 23. Dorsal fin origin near midpoint of body; anal fin with 38 to 53 finrays, its origin below hind part of dorsal fin base. Swimbladder with a single long tube passing back down right side of body above anal fin base. Resembles I. elongata, I. filigera, I. macrogaster and I. pristigastroides in this swimbladder character, but these have more scutes (total 34 to 42). Other Ilisha species have either twin tubes from the hind end of the swimbladder (and usually only 25 to 30 scutes) or no posterior tubes (and more or fewer scutes). Pellona species have a distinct toothed hypo-maxilla. See CLUP Ilish 4, Fishing Area 51, also 57, 71.



Geographical Distribution : Indian Ocean (Bombay to Bay of Bengal and Andaman coast of Thailand), Java Sea (off Java, Singapore). Sarawak, 'Cochinchina' and Macao specimens of Ramaiyan & Whitehead (1975) should be rechecked.

Habitat and Biology : Marine, pelagic, inshore, but apparently occurs also in rivers (Ganges at Allahabad, rivers of eastern Uttar Pradesh - see Wongratana, 1980), but not in Vellar estuary (Ramaiyan & Whitehead, 1975); Day (1875:644) referred to Pellona motius (if this was indeed the present species) as riverine, "descending as low as the coast" and gave its size as not much over 4 inches, i.e. about 10 cm standard length; this would suggest that I. megaloptera ascends and spawns in rivers. Feeds on fishes, crustaceans, amphipods, occasionally polychaetes, tunicates and small amounts of algae and diatoms.

Size : To 27.5 cm standard length.

Interest to Fisheries : No separate statistics, but it is perhaps the commonest species of Ilisha in the Indian Ocean and must make a significant contribution to artisanal catches of clupeoids. Caught mainly by gillnets and boat seines in India (even found in trawl catches from 30 to 40 m).

Local Names : INDIA: Phansa (Calcutta, but probably the same name used for other species of Ilisha).

Literature : Ramaiyan & Whitehead (1975); other identifications in the literature cannot be wholly relied upon.

Ilisha melastoma (Schneider, 1801)

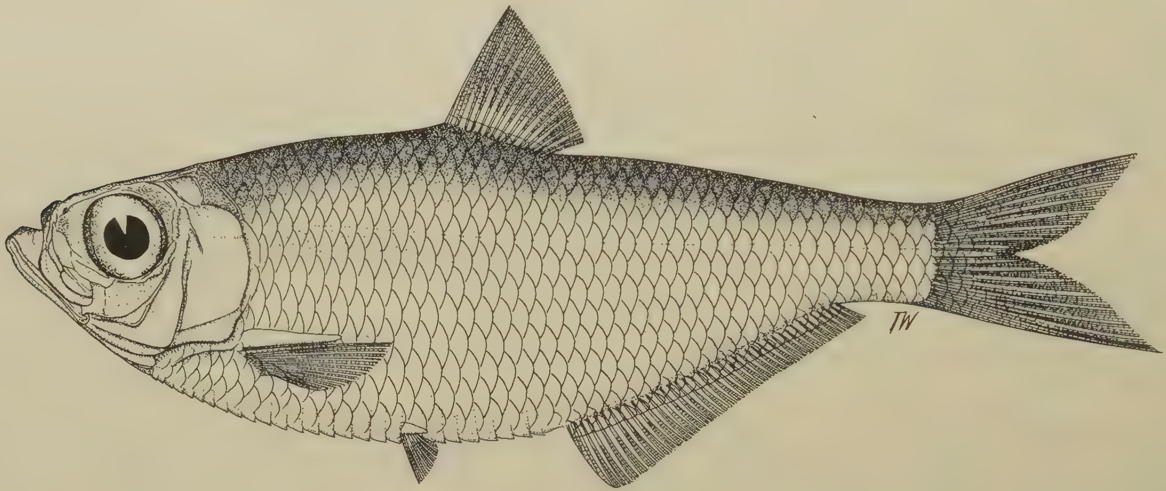
PRIST Ilish 3

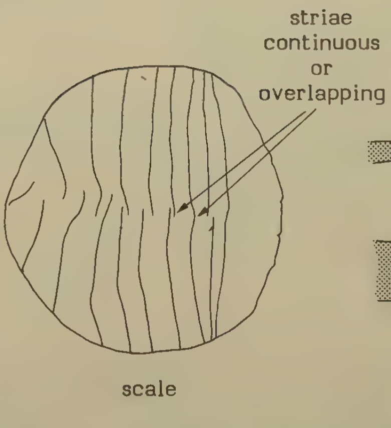
Formerly CLUP Ilish 3

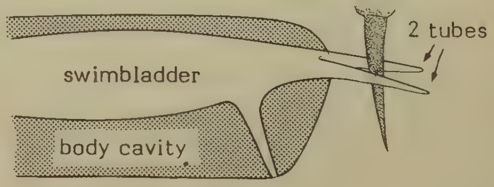
Clupea melastoma Schneider, 1801, *Syst.Ichthyol.Bloch.*:427 (near Coromandel).

Synonyms : *Platygaster verticalis* Swainson, 1838:278 (on *Ditchoee* of Russell, 1803); *Platygaster indicus* Swainson, 1839:294 (on *Ditchoee*); *Pellona ditchoa* Valenciennes, 1847:313 (on Ditchoee); *Pellona micropus* Valenciennes, 1847:320 (Coromandel coast; in part, the other specimen being *Ilisha obfuscata*); *Pellona brachysoma* Bleeker, 1852:22 (Jakarta); Weber & de Beaufort, 1913:87 (on Bleeker); *Ilisha brachysoma*:Fowler, 1941:653 (Padang, Sumatra); Whitehead *et al.*, 1966:100, pl. 13, fig. 1 (Bleeker's fig.) (type of *brachysoma*); *Ilisha indica*:Fowler, 1941:652 (Bombay, Calicut, Jakarta, large synon.); Whitehead, 1967:116 (type of *ditchoa*); *Ilisha micropus*:Whitehead, 1967:115,116 (type of *micropus*); *Ilisha melastoma* - Fowler, 1941:659 (Sandakan Bay, Kalimantan, large synon.); Whitehead, 1973b:212, fig. 37 (key, synon., refs); Ramaiyan & Whitehead, 1975:189, fig. 1a-c (key, descr.; Karachi to Hong Kong); Wongratana, 1980:211, pls 175, 176 (revision).

FAO Names : En - Indian ilisha.







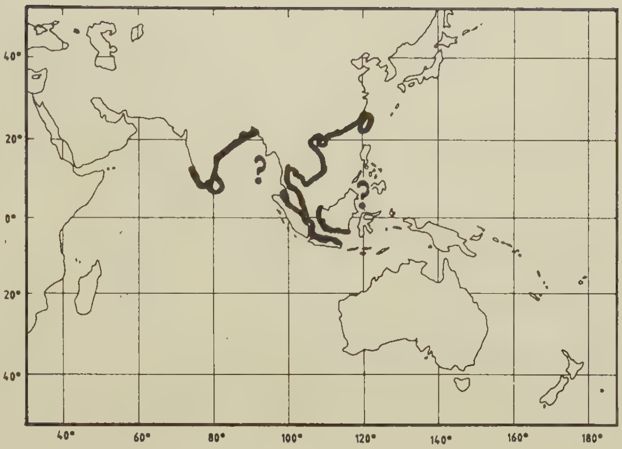
Diagnostic Features : Body moderately deep, its depth 33 to 42% of standard length, belly with usually 17 to 21 + 8 or 9, total 25 to 30 scutes. Eye large, lower jaw projecting; lower gillrakers 21 to 25. Dorsal fin origin a little before midpoint of body; anal fin with 35 to 48 finrays, its origin under hind part of dorsal fin base. Vertical striae on scales traversing whole scale or overlapping across centre of scale. Swimbladder with two tubes passing back in the muscles on either side of haemal spines. Resembles three other Indo-Pacific species of *Ilisha* in this swimbladder character, but these have more gillrakers (*I. obfuscata*) or scale striae not continuous, with a distinct gap across centre of scale (*I. kampeni*, *I. striatula*). Other *Ilisha* species have either a single long tube from the hind end of the swimbladder (and more scutes), or no posterior tubes (and a more slender body or a distinct bony lobe on the shaft of the maxilla behind the tip of the pre-maxilla). *Pellona* species have a distinct toothed hypo-maxilla. See CLUP Ilish 3, Fishing Area 51, also 57, 71.

Geographical Distribution : Indian Ocean (Malabar coast to Calcutta), Java Sea (off Java), South China Sea (Singapore, Gulf of Thailand), East China Sea (north to Taiwan Island).

Habitat and Biology : Marine, pelagic, coastal, but entering estuaries and presumably able to tolerate lowered salinities. Feeds on plankton (probably small crustaceans, etc.).

Size : To 17 cm standard length.

Interest to Fisheries : Contributes to clupeoid catches by artisanal fisheries. Mostly caught by gill-nets and boat seines over depths of 10 to 15 m along coasts and in estuaries, also by cast nets in estuaries (southern India).



Local Names : -

Literature : Ramaiyan & Whitehead (1975 - brief notes on distribution and biology, but Karachi record is I. striatula).

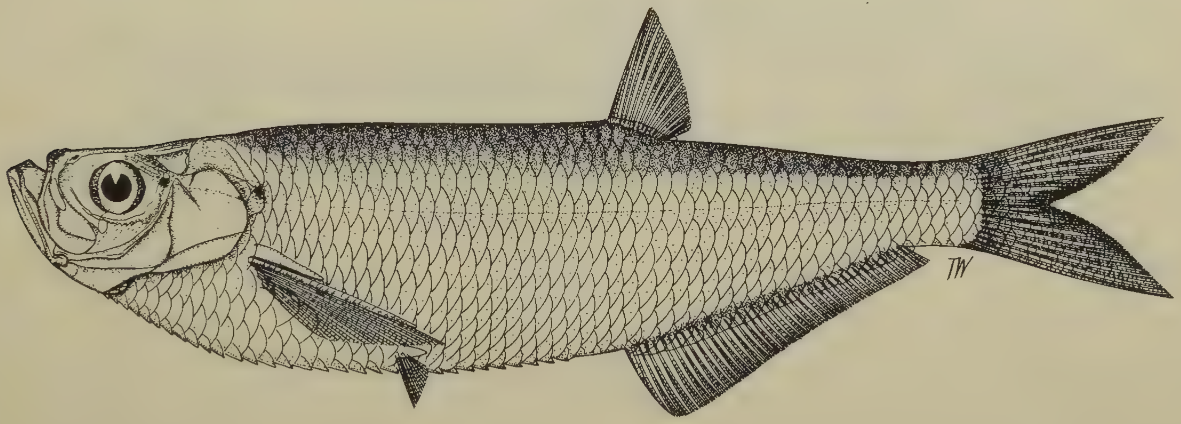
Ilisha novacula (Valenciennes, 1847)

PRIST Ilish 10

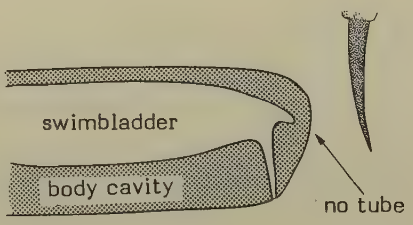
Pellona novacula Valenciennes, 1847, Hist.nat.poiss., **20**:319 (Rangoon).

Synonyms : Pellona sladeni Day, 1869:623 (Irrawady River at Mandalay); Ilisha sladeni:Fowler, 1941:657 (compiled); Whitehead, 1971:74 (type of sladeni); Idem, 1973b:211 (key only); Whitehead & Talwar, 1976:155 (type of sladeni, listed); Ilisha elongata:Whitehead, 1967:121 (type of novacula); Wongratana, 1980:199, pls 161, 162 (revision).

FAO Names : En - Burmese River ilisha.



Diagnostic Features : Body rather slender, its depth 22 to 27% of standard length, belly with 24 to 25 + 10 or 11, total 34 to 36 scutes. Eye large, lower jaw strongly projecting; lower gillrakers 21 to 23. Dorsal fin origin behind midpont of body; anal fin with 43 to 45 finrays, its origin below dorsal fin base. Swimbladder without a posterior tube (or tubes) passing backward into the body muscles. Resembles I. sirishai in this swimbladder character, but that species has a distinct bony lobe on the shaft of the maxilla behind the tip of the pre-maxilla, fewer scutes (total 28 or 29), more gillrakers (22 to 26) and a deeper body (depth 32 to 37%). Other Ilisha species have one or two thin tubes passing backward from the swimbladder, also fewer scutes (26 to 30) or a deeper body (27 to 39%). Pellona species have a distinct toothed hypo-maxilla and are deep-bodied; Opisthopterus species have the anal fin origin well in advance of the dorsal fin origin.



Geographical Distribution : Burma rivers (Irrawaddy at Rangoon and Mandalay; Sittang River).

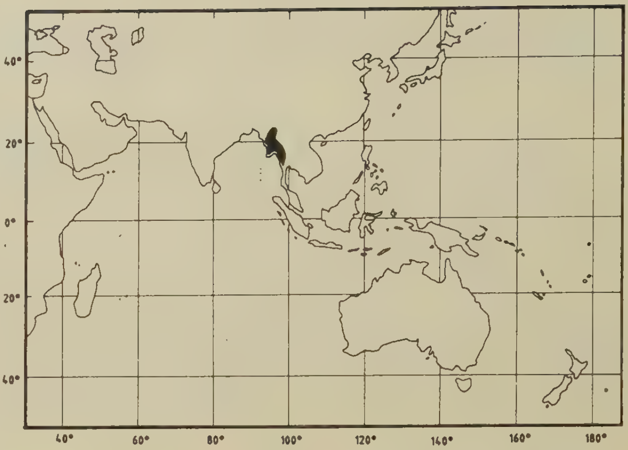
Habitat and Biology : Riverine, reaching at least 650 km up the Irrawaddy, perhaps more. More data needed.

Size : To 32 cm standard length.

Interest to Fisheries : Perhaps of local interest, but no special fishery.

Local Names : -

Literature : See under Synonyms.



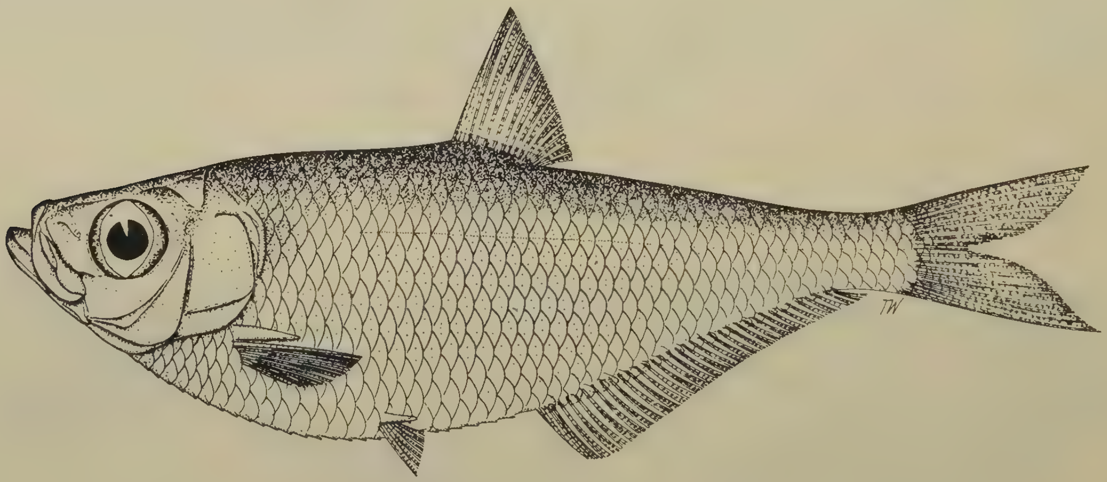
Ilisha obfuscata Wongratana, 1983

PRIST Ilish 11

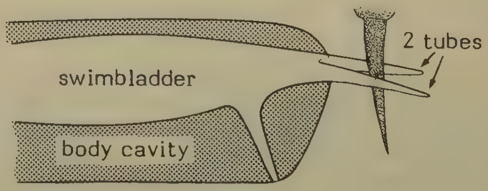
Ilisha obfuscata Wongratana, 1983, *Jap.J.Ichthyol.*, **29**(4):397, fig. 14 (Bombay, Pondicherry; on a syntype of *Pellona filigera* Valenciennes and a paralectotype of *Pellona micropus* Valenciennes, i.e. *I. melastoma*).

Synonyms : None.

FAO Names : En - Hidden ilisha.



Diagnostic Features : Body moderately deep, its depth 34 or 35% of standard length, belly with 19 or 20 + 8, total 27 or 28 scutes. Eye large, lower jaw projecting; lower gillrakers 27 or 28 (2 fishes only). Dorsal fin origin at about midpoint of body; anal fin with 39 to 42 finrays, its origin under or just behind final dorsal fin rays. Vertical striae on scales traversing whole scale or overlapping across centre of scale. Swimbladder with two very short tubes passing back in the muscles on either side of haemal spines (not reaching back beyond vertical from about 10th anal finray base). Resembles three other Indo-Pacific species in its paired swimbladder tubes, but these all have fewer gillrakers (25 or less; *I. melastoma*, *I. striatula*, *I. kampeni*). Other *Ilisha* species have fewer gillrakers and either a single long tube from the hind end of the swimbladder (and more scutes), or no posterior tubes (and a more slender body or a distinct bony lobe on the shaft of the maxilla behind the tip of the pre-maxilla). *Pellona* species have a distinct toothed hypo-maxilla.



Geographical Distribution : Indian Ocean (only known from Bombay and Pondicherry).

Habitat and Biology : Marine, pelagic, coastal. More specimens and data needed.

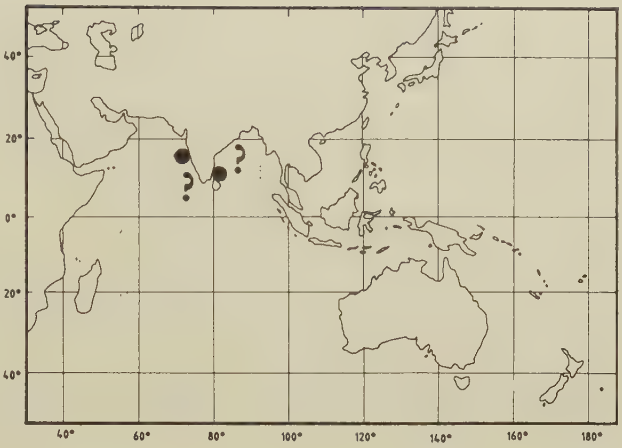
Size : To 7.4 cm standard length, but probably grows larger.

Interest to Fisheries : No data.

Local Names : -

Literature : Probably mixed with records of *I. filigera* and other species of Indian coasts.

Remarks : The only two specimens known came from the type series of *filigera* and *micropus*. The species is unique among Indo-Pacific *Ilisha* in its high gillraker count and very short swimbladder tubes.



Ilisha pristigastroides (Bleeker, 1852)

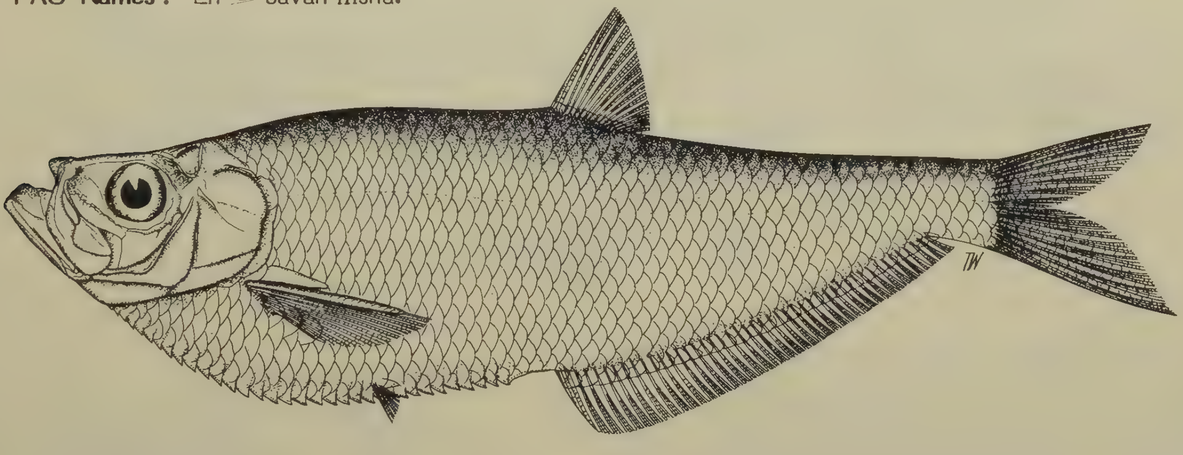
PRIST Ilish 1

Formerly CLUP Ilish 1

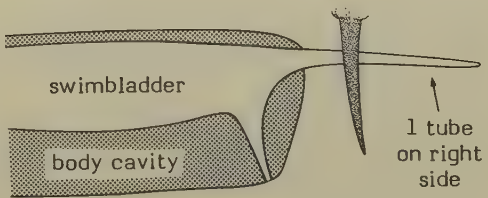
Pellona pristigastroides Bleeker, 1852, *Verh.batav.Genoot.Kunst.Wet.*, **24**:20 (Jakarta).

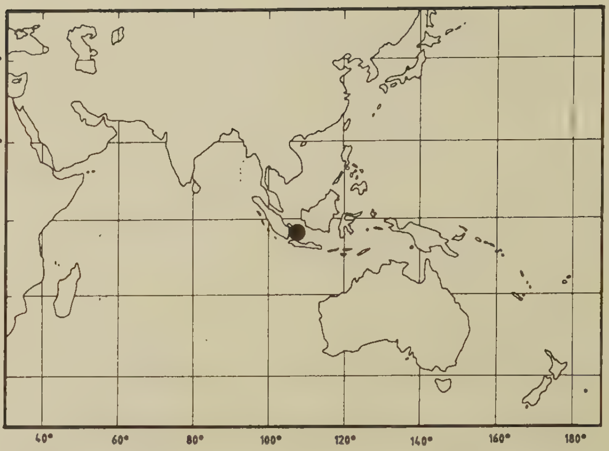
Synonyms : *Pellona amblyuropterus* Bleeker, 1852:21 (Jakarta; Weber & de Beaufort, 1913:90 (Java, Sumatra, Kalimantan, Singapore); *Ilisha amblyuroptera*:Fowler, 1941:656 (compiled); *Ilisha pristigastroides* - Whitehead *et al.*, 1966:93, 94, pl. 11, fig. 3 (Bleeker fig.) (types of *pristigastroides*, *ambluropterus*); Whitehead, 1973b:211 (key only); Wongratana, 1980:208, pl. 170 (revision).

FAO Names : En - Javan ilisha.



Diagnostic Features : Body moderately slender, its depth 31 or 32% of standard length, belly with 26 or 27 + 11 or 12, total 37 to 39 scutes. Eye large, lower jaw projecting; lower gillrakers 17 (3 fishes). Dorsal fin origin behind midpoint of body; anal fin with 45 or 46 finrays, its origin below front part of dorsal fin base. Swimbladder with a single long tube passing back down right side of body above anal fin base. Resembles four other Indo-Pacific species of *Ilisha* in this character, but they have fewer scutes (*I. megaloptera*) or more gillrakers (*I. elongata*, *I. filigera*, *I. macrogaster*). Other *Ilisha* species have either twin tubes from the hind end of the swimbladder or no posterior tubes (and more gillrakers and fewer scutes). *Pellona* species have a distinct toothed hypo-maxilla. See CLUP Ilish 1, Fishing Areas 57, 71.





Geographical Distribution : Java Sea (Jakarta).

Habitat and Biology : Marine, pelagic, coastal, apparently entering rivers and brackishwater (Weber & de Beaufort, 1913 - as Pellona pristigastroides and P. amblyuropterus).

Size : To 30 cm standard length.

Interest to Fisheries : No data.

Local Names : INDONESIA: Ikan puput.

Literature : See under Synonyms.

Remarks : Wongratana (1980) was able to examine only three specimens, but the species seems to be distinct.

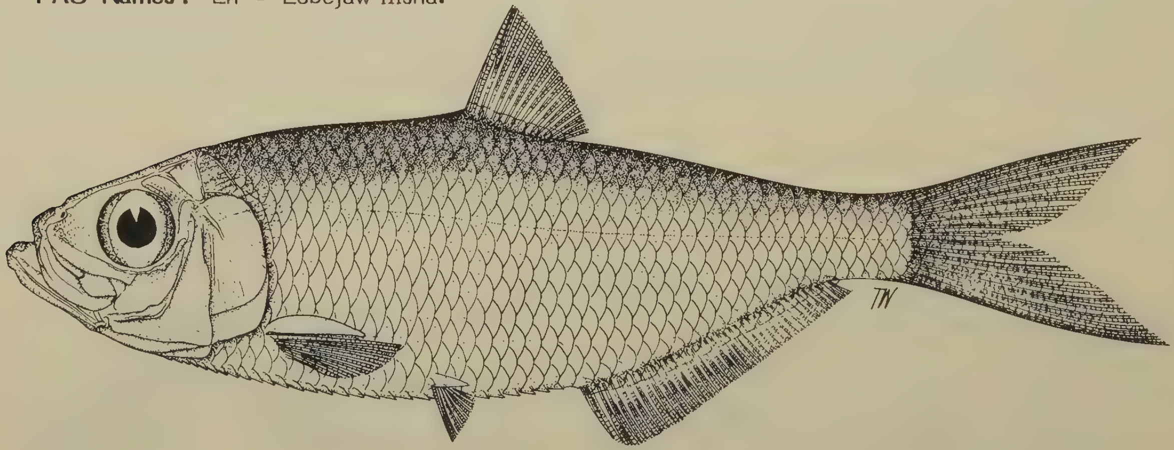
Ilisha sirishai Seshagiri Rao, 1975

PRIST Ilish 12

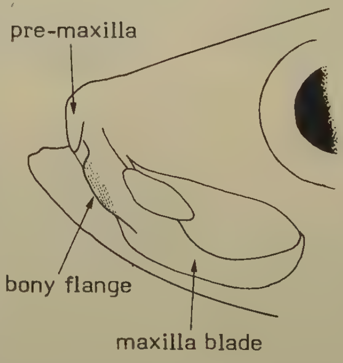
Ilisha sirishai Seshagiri Rao, 1975, Hydrobiologia, **47**:463, figs 1, 2 (Vizagapatnam, India).

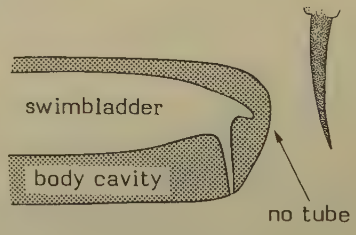
Synonyms : Ilisha sirishai - Wongratana, 1980:198, pls 159, 160 (revision).

FAO Names : En - Lobejaw ilisha.

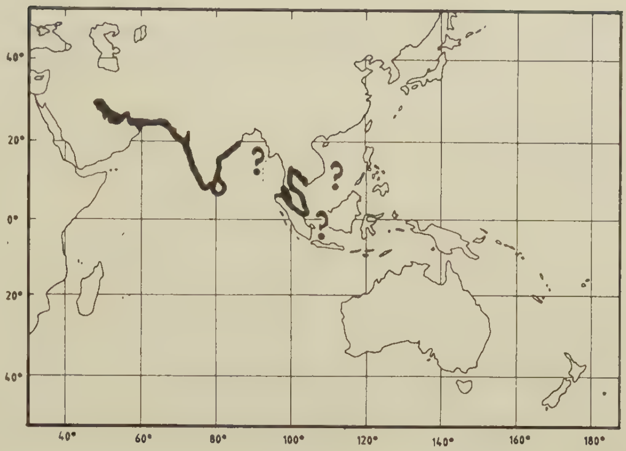


Diagnostic Features : Body moderately deep, its depth 32 to 37% of standard length, belly with 18 to 21 + 8 or 9, total usually 28 or 29 scutes. Eye large, lower jaw strongly projecting; shaft of maxilla with a distinct lobe or flange between hind tip of pre-maxilla and blade of maxilla; lower gillrakers 22 to 26. Dorsal fin origin near or before midpoint of body; anal fin with 39 to 43 finrays, its origin a little behind dorsal fin base. Swimbladder without a posterior tube (or tubes) passing backward into the body muscles. Resembles I. novacula in this swimbladder character, but that species has no lobe on the maxilla, more scutes (total 34 to 36), fewer gillrakers (21 to 23) and is more slender (depth 22 to 27%). Other Ilisha species have one or two thin tubes passing backward from the swimbladder, also usually more scutes or more gillrakers or are more slender, and none has a lobe on the maxilla (I. striatula and I. melastoma are otherwise very similar to I. sirishai). Pellona species have a distinct toothed hypo-maxilla in place of the lobe on the maxilla.





Geographical Distribution : Indian Ocean (from the "Gulf" to Bay of Bengal and Andaman coast of Thailand), Gulf of Thailand (Songkhla Lake).



Habitat and Biology : Marine, pelagic and inshore, presumably able to tolerate some lowering of salinity. More data needed.

Size : To 17.2 cm standard length.

Interest to Fisheries : Contributes to artisanal catches of clupeoids, but no special fishery.

Local Names : -

Literature : Dehadrai (1960 - swimbladder, as *I. indica*).

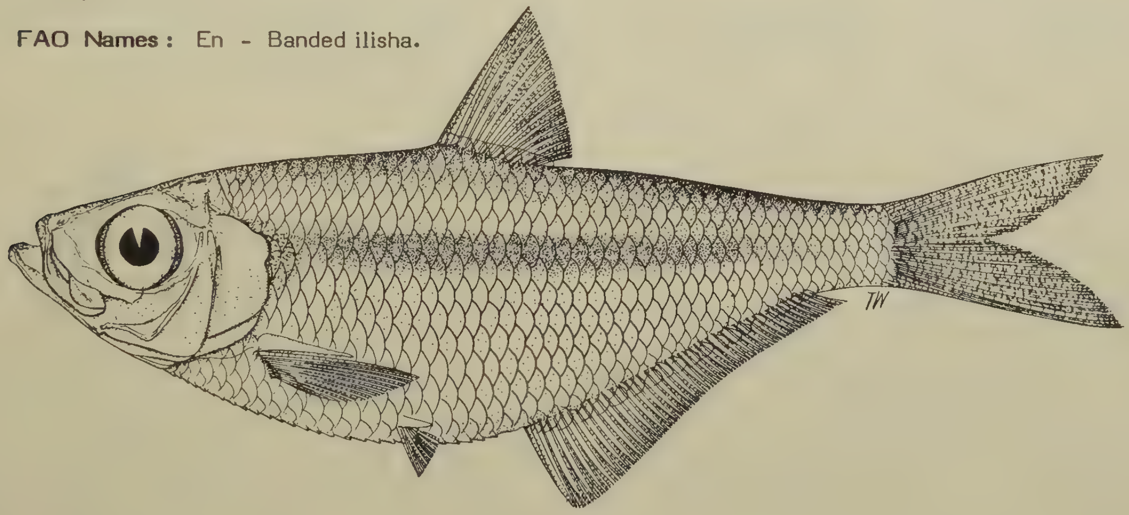
Ilisha striatula Wongratana, 1983

PRIST Ilish 13

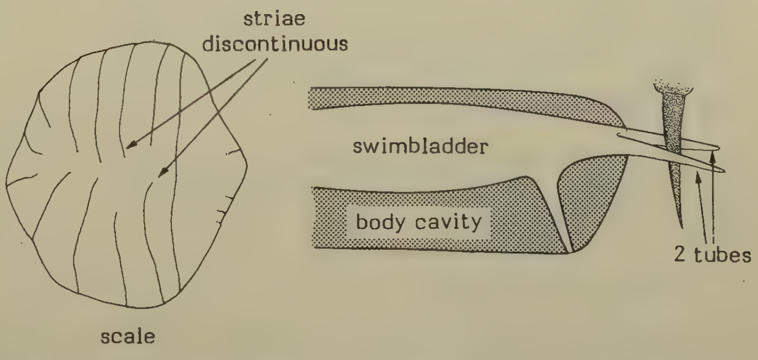
Ilisha striatula Wongratana, 1983, *Jap.J.Ichthyol.*, **29**(4):396, fig. 13 (Karachi, Porto Novo, Madras, Tuticorin).

Synonyms : None.

FAO Names : En - Banded ilisha.



Diagnostic Features : Body moderately deep, its depth 32 to 39% of standard length, belly with usually 18 to 21 - 7 to 9, total 26 to 29 scutes. Eye large, lower jaw projecting; lower gillrakers 21 to 24. Dorsal fin origin a little before midpoint of body; anal fin with 40 to 47 finrays, its origin below final dorsal finray bases. Vertical striae on scales not continuous, but with a distinct gap across centre of scale. A faint dark band along flanks. Swimbladder with two tubes passing back in the muscles on either side of haemal spines. Resembles three other Indo-Pacific species of *Ilisha* in this swimbladder character, but these have more gillrakers (*I. obfuscata*), or scale striae that traverse the scale (*I. melastoma*) or are more slender and have shorter pectoral fins (*I. kampeni*; pectoral fin 15 to 17% of standard length, cf. 18 to 21%). Other *Ilisha* species have either a single long tube from the hind end of the swimbladder (and more scutes), or no posterior tubes (and a more slender body or a distinct bony lobe on the shaft of the maxilla behind the tip of the pre-maxilla). *Pellona* species have a distinct toothed hypo-maxilla.



Geographical Distribution : Indian Ocean (Karachi to Madras and perhaps north to Calcutta); specimens from the northwestern coasts of Australia may be this species.

Habitat and Biology : Marine, pelagic, coastal, but probably also entering estuaries. More data needed.

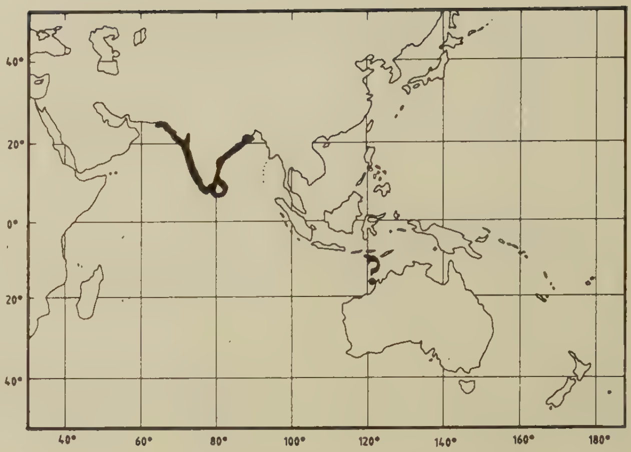
Size : To 18 cm standard length.

Interest to Fisheries : Probably caught with I. melastoma.

Local Names : -

Literature : See under Synonyms.

Remarks : Almost certainly confused in the past with the very similar I. melastoma in Indian waters.



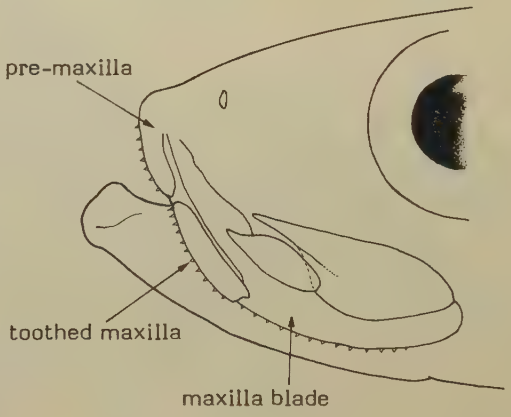
Pellona Valenciennes, 1847

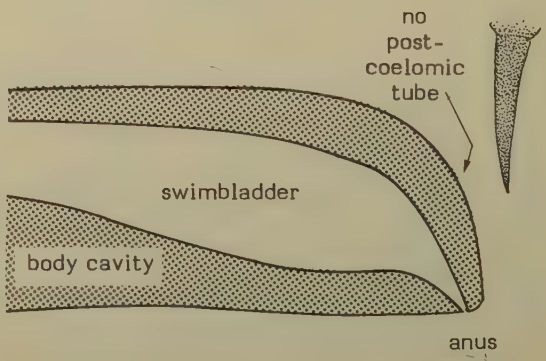
PRIST Pell

Formerly CLUP Pell

Pellona Valenciennes, 1847, Hist.nat.Poiss., **20**:300 (type: Pellona orbignyana Valenciennes = Pristigaster flavipinnis (Valenciennes). Neosteus Norman, 1923, Ann.Mag.nat.Hist., (9)**11**:17 (type: Pellona ditchela Valenciennes).

Diagnostic Features : Moderate or large-sized marine, estuarine or freshwater clupeoid fishes (to about 50 cm standard length), body moderately deep or elongate, compressed, with a sharp keel of scutes along belly. Eye fairly large; lower jaw projecting, mouth directed obliquely upward; upper jaw reaching at most to eye centre; a small toothed hypo-maxilla between hind tip of pre-maxilla and blade of maxilla (easily detected by rubbing a finger-nail along the lower edge of the jaw); jaw teeth small or minute, usually with a distinct gap at centre of upper jaw. Gillrakers fairly short and thick, few, 20 to 31 (but anterior gillrakers regress in some South American Pellona over 30 cm standard length). Dorsal fin at about midpoint of body; pelvic fins present, small, with 6 or 7 finrays, a little or well in front of dorsal fin origin; anal fin moderately long, with 34 to 43 finrays, its origin under or just behind dorsal fin base. Scales moderate, about 35 to 50 in lateral series. No distinctive colour patterns. No tube or tubes at hind end of swimbladder passing backward into body muscles (cf. species of Ilisha). Pellona strongly resembles Ilisha, but the latter lacks a toothed hypo-maxillary bone in the upper jaw.





Biology, Habitat and Distribution : Marine, pelagic and inshore in Indo-Pacific, marine and freshwater in New World (Atlantic and its drainage; absent off Pacific coasts).

Interest to Fisheries : Contribute to artisanal fisheries.

Species : Wongratana (1980) recognized 2 Indo-Pacific species, and Whitehead (1973a) 3 New World species:

Indo-West Pacific

P. dayi Wongratana, 1983, India, Indonesia
P. ditchela Valenciennes, 1847, East Africa to Papua New Guinea.

New World

P. castelnaeana Valenciennes, 1847, Orinoco, Amazon, freshwater
P. flavipinnis (Valenciennes, 1837), Orinoco to Buenos Aires, freshwater
P. harroweri (Fowler, 1917), Panama to Brazil, marine.

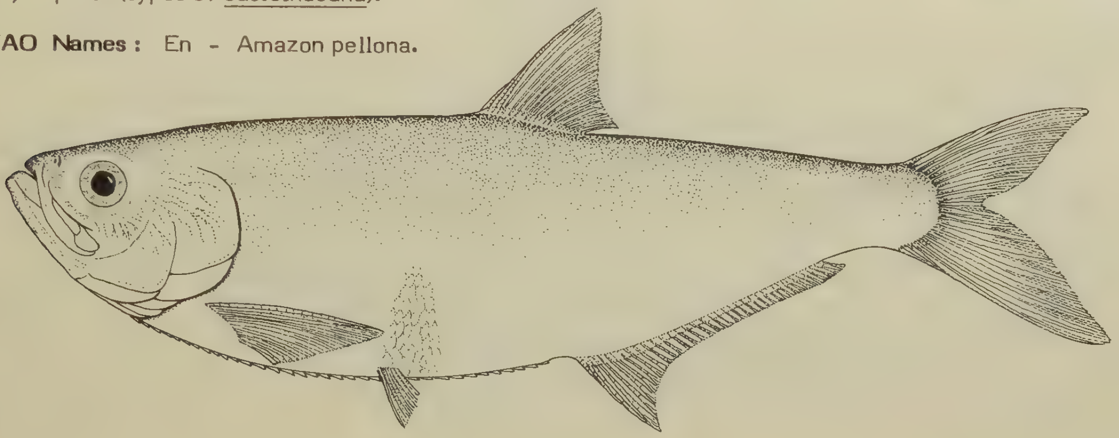
Pellona castelnaeana Valenciennes, 1847

PRIST Pell 3

Pellona castelnaeana Valenciennes, 1847, Hist.nat.Poiss., **20**:306 (Amazon mouth).

Synonyms : [Pellona polylepis, MS name of Steindachner; type NMV 1103 ex Jatuarana]; ? Pellona altamazonica Cope, 1872:256 (Ambyiacu River, Ecuador; types lost fide Böhlke, 1984:62); FWNA, 1964:417, fig. 104 (Amazon between Pará and Manáos; lower gillrakers only 12 or 13); Ilisha desuratus Nakashima, 1941:77, fig. (near Iquitos, Peruvian Amazon); Pellona castelnaeana - Whitehead, 1967:108 (types of castelnaeana); Idem, 1970:25 (key, separation from P. flavipinnis on gillrakers); Idem, 1973a:71, fig. 21 (Guianas); Whitehead & Bauchot, in press (types of castelnaeana).

FAO Names : En - Amazon pellona.



Diagnostic Features : Body moderately deep and compressed, its depth about 29 to 34% of standard length, belly with 23 or 24 + 8 to 11, total 33 or 34 scutes. Lower jaw projecting; upper jaw with a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla blade (easily felt with finger-nail); lower gillrakers 12 to 14 (in fishes of 20 to 50 cm standard length). Pelvic fins present, with a distinct axillary scale; anal fin long, its origin under dorsal fin base, with about 34 to 38 finrays. Scales fairly small, about 70 in lateral series. Closely resembles P. flavipinnis, which has more lower gillrakers (23 to 31) and more post-pelvic scutes (13 or 14); P. harroweri has only 5 to 7 post-pelvic scutes and no pelvic axillary scale. Ilisha amazonica lacks a toothed hypo-maxilla. Other similar clupeoids have a shorter anal fin (less than 30 finrays).

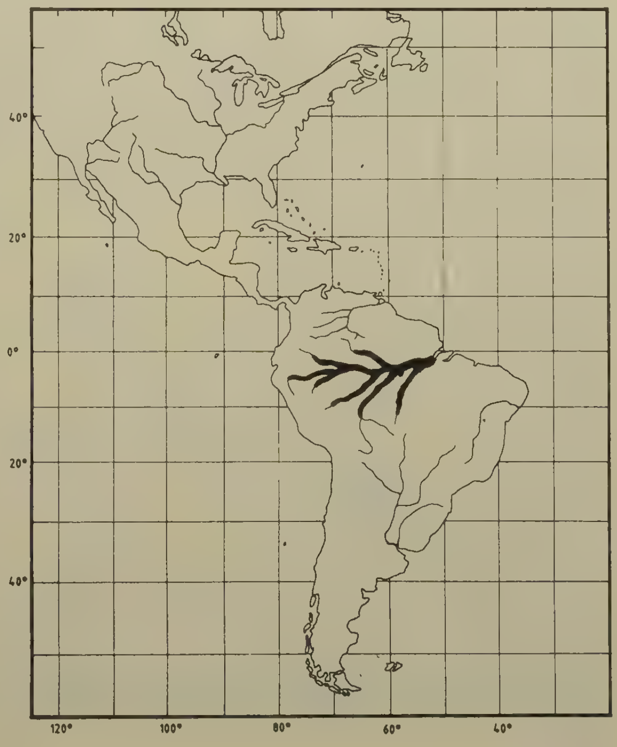
Geographical Distribution : Amazon system (Iquitos on Peruvian Amazon and Ambyiacos River in Ecuador to Manáos and perhaps Pará), the Guianas (Lake Amuku area where the Amazon and Essequibo systems join in wet years).

Habitat and Biology : Riverine, apparently not entering the sea, although presumably tolerating at least some salinity at the Amazon mouth. More data needed.

Size : To at least 47 cm standard length.

Interest to Fisheries : Almost certainly caught by artisanal fishermen on the Amazon.

Local Names : -



Literature : See under Synonyms; otherwise not clearly distinguished from P. flavipinnis

Remarks : Much confused in the literature with the superficially similar P. flavipinnis until separated by gillraker and scute counts. The ranges of the two species overlap in the Amazon drainage, at least in the middle and lower parts, so that previous biological or fishery data may apply to either species.

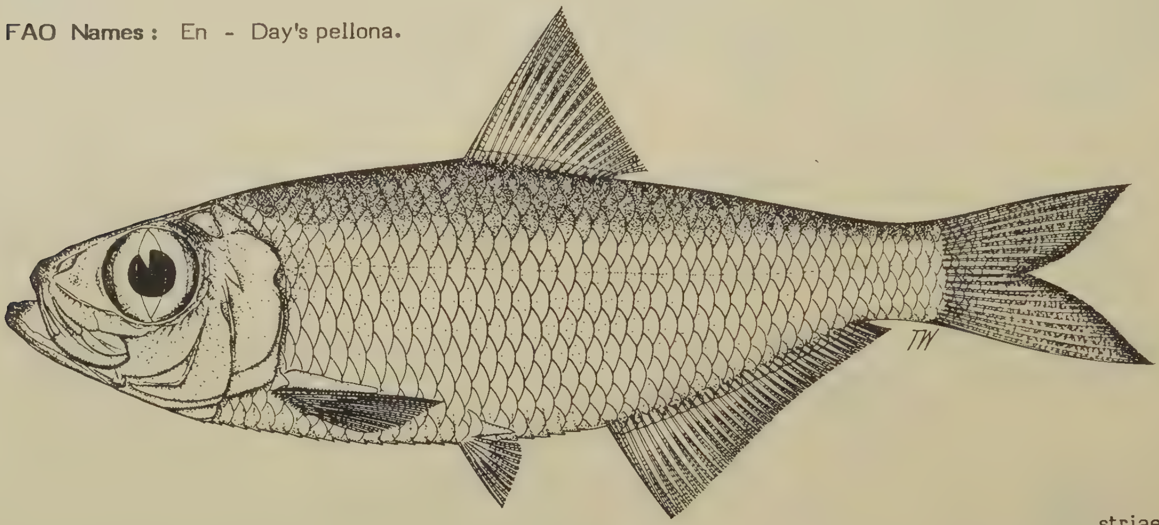
Pellona dayi Wongratana, 1983

PRIST Pell 4

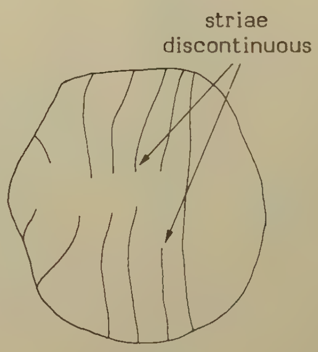
Pellona dayi Wongratana, 1983, Jap.J.Ichthyol., **29**(4):395, fig. 12 (Porto Novo, Madras).

Synonyms : None.

FAO Names : En - Day's pellona.



Diagnostic Features : Body moderately deep, compressed, belly with 19 + 8 or 9, total 27 or 28 scutes. Eye large, lower jaw projecting; upper jaw with a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla (easily felt with fingernail); lower gillrakers 20 or 21. Dorsal fin origin near midpoint of body; pelvic fins present; anal fin with 35 to 41 finrays. Scales with upper and lower vertical striae not meeting at centre of scale. Closely resembles the widespread P. ditchela, which has 22 to 27 lower gillrakers and the vertical scale striae overlapping at centre of scale. Species of Ilisha have no hypo-maxilla. Other pristigasterids are much more slender and lack pelvic fins (Opisthopterus, Raconda).



scale

Geographical Distribution : Indian ocean (on eastern coast of southern India).

Habitat and Biology : Marine, inshore and perhaps, like P. ditchela, entering estuaries.

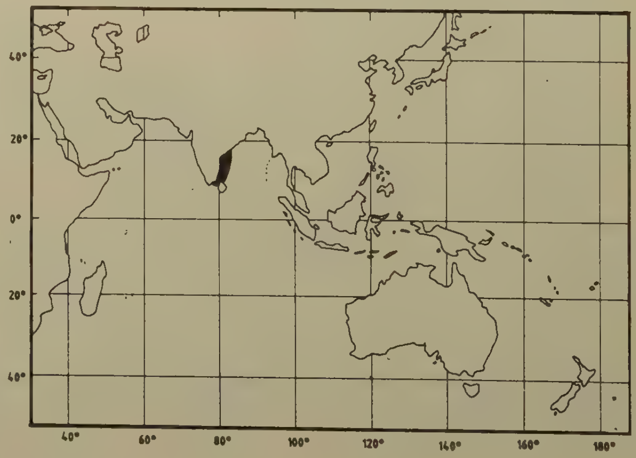
Size : To 13.5 cm standard length.

Interest to Fisheries : No data (included in catch records of P. ditchela).

Local Names : -

Literature : Presumably included in references to P. ditchela.

Remarks : Not easy to separate from P. ditchela on the scale striation character since scales easily lost. Further specimens may blur the distinction on gillraker numbers.



Pellona ditchela Valenciennes, 1847

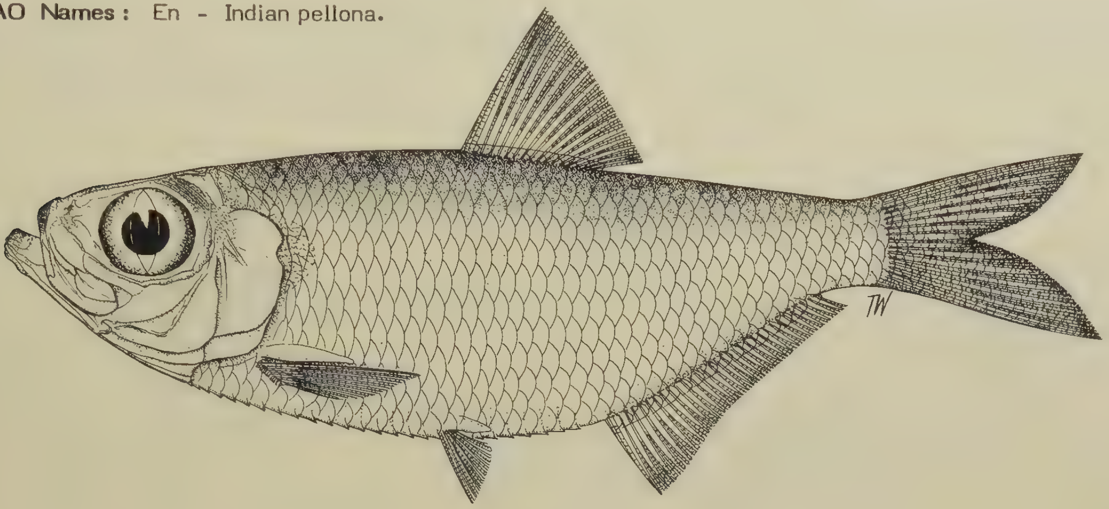
PRIST Pell 1

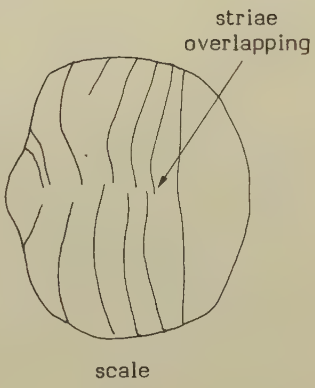
Formerly CLUP Pell 1 and
CLUP Pellon 2 (error)

Pellona ditchela Valenciennes, 1847, Hist.nat.poiss., **20**:314 (on Ditchelee of Russell, 1803).

Synonyms : Pellona hoevenii Bleeker, 1862:21 (Jakarta); Weber & de Beaufort, 1913:86, fig. 29 (jaws) (Indonesia); Pellona natalensis Gilchrist & Thompson, 1908:202 (Natal coast); Pellona ditchela - Fowler, 1941:648 (South Africa to Indonesia and the Philippines; large synon.); Whitehead et al., 1966:91, pl. 11, fig. 2 (Bleeker's fig.) (types of hoevenii); Losse, 1968:104 (East Africa; synon., descr.); Whitehead, 1973b:209, fig. 35 (key, synon., refs); Wongratana, 1980:195, pls 155, 156 (revision); CLOFFA, 1984:48 (African freshwater refs); SFSA, in press (South Africa).

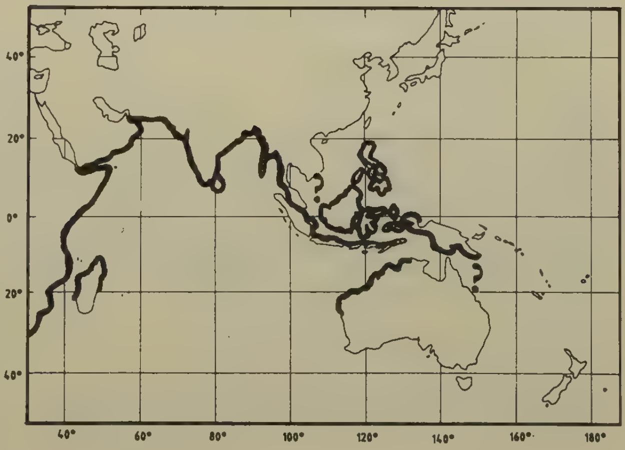
FAO Names : En - Indian pellona.





Diagnostic Features : Body moderately deep, compressed, belly with usually 18 or 19 + 8 or 9, total 26 to 28 scutes. Eye large, lower jaw projecting; upper jaw with a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla blade (easily felt with fingernail); lower gillrakers 22 to 27. Dorsal fin origin near midpoint of body; pelvic fins present; anal fin with 34 to 42 finrays. Scales with upper and lower vertical striae slightly overlapping each other at centre of scales. Closely resembles P. dayi, which has only 20 or 21 lower gillrakers and the vertical scale striae not meeting at centre of scale. Species of Ilisha have no hypo-maxilla. Other pristigasterids are much more slender and lack pelvic fins (Opisthopterus, Raconda). See CLUP Pellon 2, Fishing Area 51; also CLUP Pell 1, Fishing Areas 57, 71.

Geographical Distribution : Indian Ocean (western coasts from the Gulf of Oman to Durban, also Madagascar; coasts of India and Andaman Sea, perhaps off eastern Java, and south to Western Australia), South China Sea (the Philippines), Indonesia to northern Australia and Papua New Guinea.



Habitat and Biology : Marine, coastal, but entering mangrove swamps and penetrating estuaries into freshwater (e.g. in the Pangani River, Tanzania), thus apparently fully euryhaline.

Size : To 16 cm standard length.

Interest to Fisheries : No specific fishery, but contributes to artisanal catches of clupeoids. Only Malaysian catch reported (2 542 tons in 1983).

Local Names : EAST AFRICA: Chaa (genera), Simu (Shimoni), Simu koko (Malindi); SOUTH AFRICA: Indiese pellona.

Literature : Sadasivan (1965 - general biology); Losse (1968 - description, habitat in East Africa).

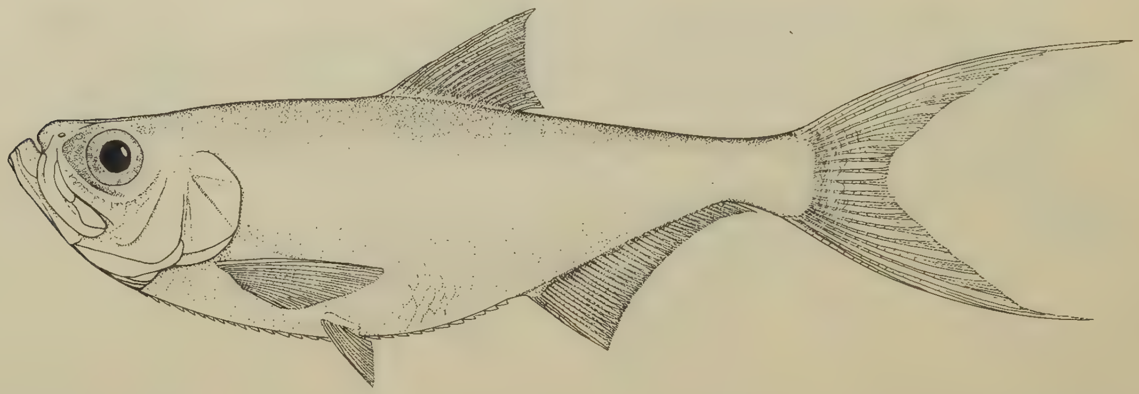
Pellona flavipinnis (Valenciennes, 1837)

PRIST Pell 5

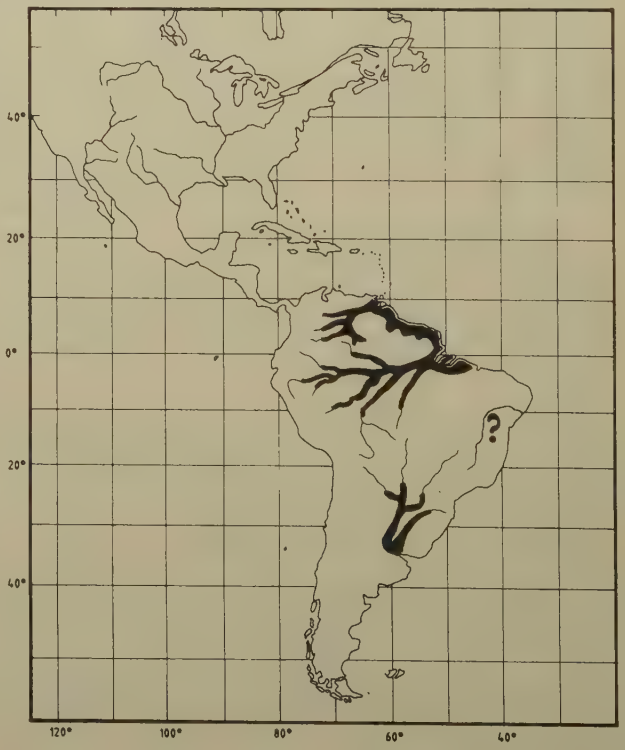
Pristigaster flavipinnis Valenciennes, 1837, in d'Orbigny, Voy.Amer.merid., Poiss., Atlas:pl. 10, fig. 2 (figure only based on Buenos Aires specimens fide Whitehead, 1967:106); Valenciennes, 1847, ibid., 5(2):8 (descr.).

Synonyms : Pellona orbignyana Valenciennes, 1847:302 (Buenos Aires); /Pellona staudingeri, MS name of Steindachner; types NMV 1112, 1893 ex Iquitos/; /Pellona macrolepis, MS name of Steindachner; type NMV 1101 ex Teffé, middle Amazon/; Ilisha castelnaeana:FWNA, 1964:419 (based on Norman, 1923; misidentified); Pellona castelnaeana:Cervigón, 1966:130 (Orinoco mouth; lower gillrakers 25, 27, thus the present species); Pellona flavipinnis - Ringuelet, Arámburu & Arámburu, 1967:60, fig. 1c (Argentina; descr. refs); Whitehead, 1967:106, 107, pl. 7a (original Valenciennes fig.) (types of flavipinnis, orbignyana); Idem, 1970:26, fig. 2 (gillraker numbers) (key, distinction from P. castelnaeana; 'types' of staudingeri, macrolepis); Idem, 1973a:67, fig. 19 (Guianas); Cervigón, 1982:211 (Orinoco); Whitehead & Bauchot, in press (types of flavipinnis, orbignyana).

FAO Names : En - Yellowfin river pellona.



Diagnostic Features : Body moderately deep and compressed, its depth 30 to 37% of standard length, belly with 20 to 24 + 12 to 14, total 32 to 37 scutes. Lower jaw projecting; upper jaw with a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla blade (easily felt with fingernail); lower gillrakers 23 to 31 (in fishes of 10 to 50 cm standard length, with the lower numbers in the larger fishes). Pelvic fins present, with a distinct axillary scale; anal fin long, its origin under dorsal fin base, with 38 to 46 finrays. Scales fairly small, about 60 in lateral series. Closely resembles P. castelnaeana, which has fewer lower gillrakers (12 to 14) and fewer post-pelvic scutes (8 to 11); P. harroweri has only 5 to 7 post-pelvic scutes and no pelvic axillary scale. Ilisha amazonica lacks a toothed hypo-maxilla. Other similar clupeoids have a shorter anal fin (less than 30 finrays).



Geographical Distribution : Argentina (Rio de la Plata down to Buenos Aires, Rio Paraná), Uruguay (Rio Uruguay), Brazil (Rio Tapajoz, Amazon as far up as Rio Jurua and down probably to mouth), the Guianas (Surinam, Guyana), Venezuela and Colombia (Orinoco from Rio Manacacias at Puerto Gaitan to Orinoco mouth).

Habitat and Biology : Riverine, apparently not entering the sea, although presumably tolerating some salinity at river mouths.

Size : To 50 cm standard length.

Interest to Fisheries : Almost certainly of importance to artisanal fishermen.

Local Names : ARGENTINA: Lacha, also Lacha pelada, Salaca.

Literature : See under Synonyms; otherwise not clearly distinguished from P. castelnaena.

Remarks : See under P. castelnaeana.

Pellona harroweri (Fowler, 1917)

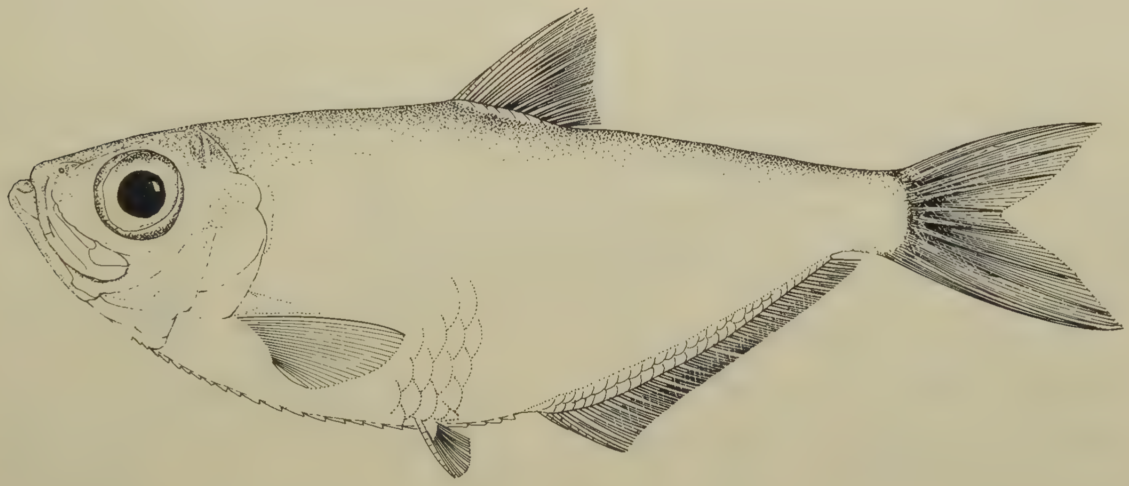
PRIST Pell 2

Formerly CLUP Pell 2

Ilisha harroweri Fowler, 1917, Proc.Acad.nat.Sci.Philad., **69**:128, fig. 1 (Colón, Panama).

Synonyms : Ilisha naragansetae Fowler, 1911:208, fig. 1 (Newport, Rhode Island); Neosteus ternetzi Norman, 1923:595 (Rio de Janeiro); Ilisha argentata Hildebrand, 1923:190, pl. 9 (Fox Bay, Colón, Panama); Pristigaster vanderbilti Borodin, 1928:6, fig. 1 (Panama; abnormal specimen lacking pelvic fins fide Hildebrand, 1964:426); Neosteus mayrinki Pinto, 1972:2 (Bacia do Parnaiba, Brazil); Ilisha harroweri:FWNA, 1964:423, fig. 106 (descr., synon.); Pellona harroweri - Cervigón, 1966:128, fig. 54 (Venezuela); Whitehead, 1973a:61, fig. 16 (key, synon., descr., Guianas specimens); Figueiredo & Menezes, 1978:25, fig. 31 (Brazil, synopsis).

FAO Names : En - American coastal pellona.



Diagnostic Features : Body fairly deep and compressed, its depth about 35 to 42% of standard length, belly with 17 to 20 + 5 to 7, total 22 to 26 scutes. Eye large, lower jaw projecting; upper jaw with a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla blade (easily felt with fingernail); lower gillrakers 23 to 25. Pelvic fins present, without a distinct axillary scale; anal fin long, its origin under middle of dorsal fin base, with 36 to 42 finrays. Scales easily lost. Resembles P. castelnaeana and P. flavipinnis, which have more post-pelvic scutes (8 to 14) and a distinct pelvic axillary scale. Ilisha amazonica has no hypo-maxilla. Other similar clupeoids have a shorter anal fin (less than 30 finrays). See CLUP Pell 2, Fishing Area 31.

Geographical Distribution : Western Atlantic (Panama to Trinidad, the Guianas, entire Brazilian coast south of the Amazon to Rio Grande do Sul at about 30°S).

Habitat and Biology : Marine, inshore, along beaches and down to at least 16 m, entering estuaries, but perhaps not tolerating very low salinities.

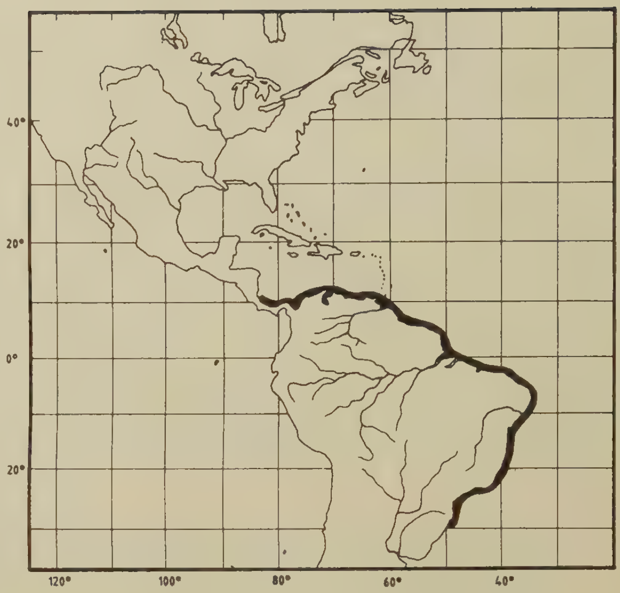
Size : To about 13 cm standard length.

Interest to Fisheries : Enters artisanal catches, but apparently not in large numbers.

Local Names : VENEZUELA: Sardina.

Literature : Matsuura (1973 - postlarva described and figured, Brazil).

Remarks : Pellona harroweri bears a remarkable resemblance, not to the two other New World species of Pellona, but to P. ditchela of the Indo-West Pacific. It differs in having fewer scutes (22 to 26; cf. 26 to 28) and fewer pelvic finrays (i 5; cf. i 6).

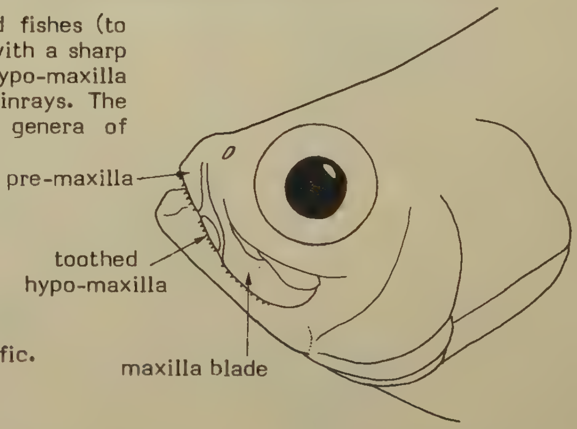


Pliosteostoma Norman, 1923

PRIST Plio

Pliosteostoma Norman, 1923, Ann.Mag.nat.Hist., (9)**11**:21 (type: Pristigaster lutipinnis Jordan & Gilbert).

Diagnostic Features : Moderate-sized marine clupeoid fishes (to about 15 cm standard length), body elongate and compressed, with a sharp keel of scutes along belly. Lower jaw strongly projecting; hypo-maxilla present. Pelvic fins absent; anal fin long, with around 50 finrays. The hypo-maxilla distinguishes it from all other pristigasterid genera of Pacific coasts (see species for further distinctions).



Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : A single species recognized:

P. lutipinnis (Jordan & Gilbert, 1881), eastern central Pacific.

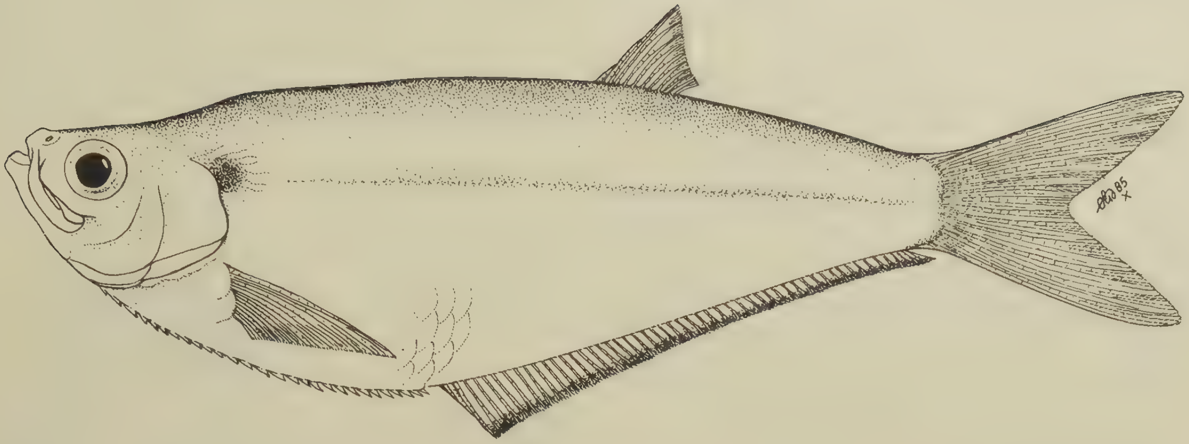
Pliosteostoma lutipinnis (Jordan & Gilbert, 1881)

PRIST Plio 1

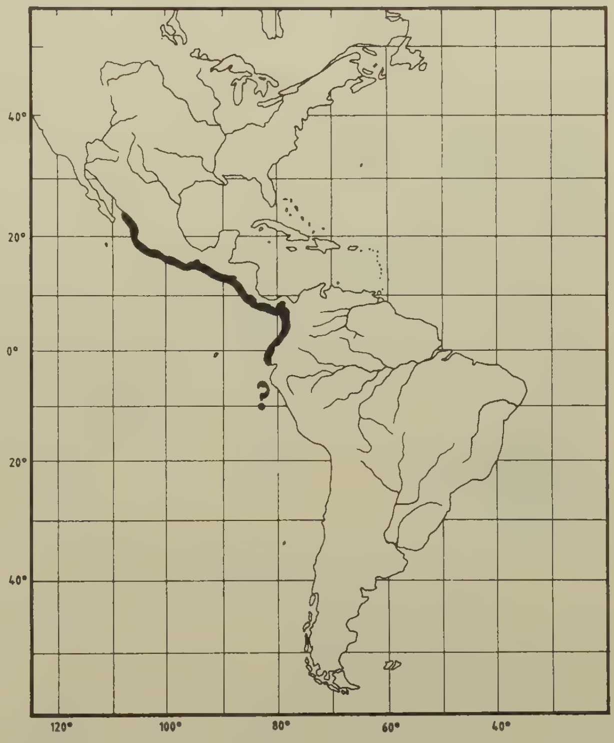
Pristigaster lutipinnis Jordan & Gilbert, 1881, Proc.U.S.natn.Mus., **4**:340 (Mazatlán, Mexico).

Synonyms : Opisthopterus lutipinnis:Jordan & Evermann, 1896:437 (Mazatlán); Pliosteostoma lutipinnis - Norman, 1923:21 (Mazatlán, Mexico); Peterson, 1956:180 (Barranca Bay, Costa Rica); Anon., 1976:67, 68 (Mexico; key, listed).

FAO Names : En - Yellowfin herring.



Diagnostic Features : Body elongate, compressed, its depth about 25% of standard length, belly with about 27 or 28 scutes. Lower jaw strongly projecting, mouth pointing obliquely upward; a distinct toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla blade (small, but can be felt with fingernail); upper jaw not reaching back beyond eye centre. Lower gillrakers around 18 to 20. Dorsal fin behind midpoint of body; pelvic fins absent; anal fin long, with 49 to 51 finrays, its origin a little before dorsal fin origin. A silver band along flank. No other Pacific coast pristigasterid has a hypo-maxilla; in addition, *Ilisha furthii* has pelvic fins, species of *Odontognathus* have a long upper jaw (reaching back to gill opening), and *Neoopisthopterus tropicus* has a terminal mouth. Resembles very closely the Pacific species of *Opisthopterus*, which have the anal fin very much in advance of dorsal fin origin and more anal finrays (55 to 62).



Geographical Distribution : Eastern central Pacific (Mazatlán, Mexico south to Colombia).

Habitat and Biology : Marine, coastal. More data needed.

Size : To 14.3 cm standard length.

Interest to Fisheries : Probably little.

Local Names :

Literature : See under Synonyms.

Chirocentrodon Günther, 1868

PRIST Chiro

Formerly CLUP Chiro

Chirocentrodon Günther, 1868, Cat.Fish.Brit.Mus., **7**:463 (type: Chirocentrodon taeniatus Günther = Pellona bleekeriana Poey). Medipellona Jordan & Seale, 1926, Bull.Mus.comp.Zool.Harv., **67**(11):417 (type: Pellona bleekeriana Poey).

Diagnostic Features : Small marine clupeoid fishes (to about 9 cm standard length), body elongate and somehwat compressed, with a sharp keel of scutes along belly. Mouth terminal; no hypo-maxilla; hind tip of premaxilla meets blade of maxilla; strong conical teeth in jaws, those at front canine-like. Pelvic fins present; anal fin long, with around 40 finrays. Distinguished from all other pristigasterids and clupeids by the presence of canine teeth (but otherwise very closely resembles Neoopisthopterus).

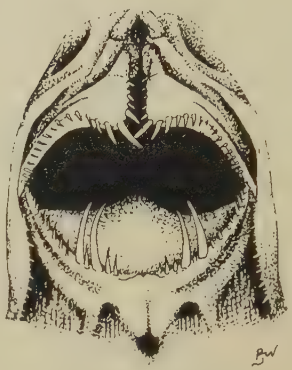
Biology, Habitat and Distribution : See species.

Interest to Fisheries : See species.

Species : A single species recognized, the scute count given by Tommazi (1964) for his C. cladileokae probably being an error:

C. bleekerianus (Poey, 1867), Atlantic coasts of Central and South America.

Remarks : Closely resembles Neoopisthopterus (see under that genus).



frontal view of mouth

Chirocentrodon bleekerianus (Poey, 1867)

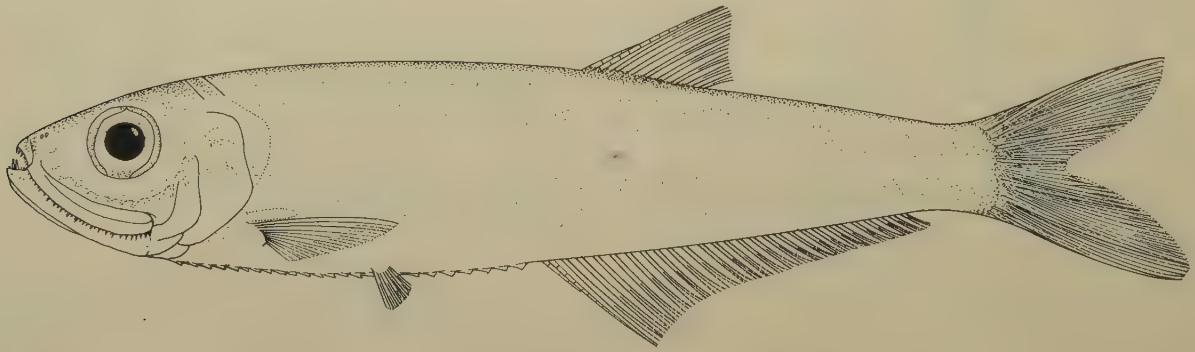
PRIST Chiro 1

Formerly CLUP Chiro 1

Pellona bleekeriana Poey, 1867, Repert.Fisico-nat.Cuba, **2**:242 (Matanzas, Cuba).

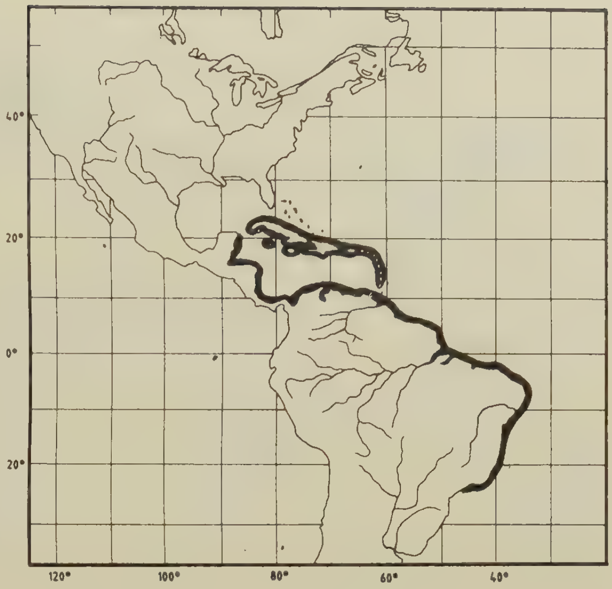
Synonyms : Chirocentrodon taeniatus Günther, 1868:463 (Jamaica); Ilisha caribbea Meek & Hildebrand, 1923:191, pl. 10, fig. 1 (Panama); Chirocentrodon cladileokae Tommazi, 1964:30 (Santos, Brazil; key, synon., descr.); Cervigón, 1966:127 (Nueva Esparta and outside Orinoco delta, Venezuela); Whitehead, 1973a:80, figs 26-29 (jaws) (Trinidad, Orinoco mouth, Guyana, Surinam); Figueiredo & Menezes, 1978:26, fig. 32 (Brazil); Uyeno, Matsuura & Fujii, 1983:90, fig. (colour photo) (Surinam).

FAO Names : En - Dogtooth herring.



Diagnostic Features : Body elongate, moderately compressed, its depth about 20 to 27% of standard length, belly with 16 or 17 (rarely 19) + 9 to 11, total 26 to 28 (rarely 30) scutes. Mouth terminal, lower jaw not strongly projecting; strong conical teeth in both jaws, continued as large and small teeth along maxilla blade, large and canine-like at front of both jaws; lower gillrakers 14 to 17. Dorsal fin origin behind midpoint of body; pelvic fins present; anal fin moderately long, with 38 to 44 finrays, its origin below or in front of dorsal fin origin. Closely resembles Neoopisthopterus cubanus in general appearance and general shape of head and jaws, but that species lacks canine-like teeth and has no pelvic fins. No other similar species has canine-like teeth. See CLUP Chiro 1, Fishing Area 31.

Geographical Distribution : Atlantic coasts of Central and South America (Cuba, Haiti, Jamaica, Puerto Rico, Trinidad; also from Panama and coasts of Venezuela, including off Orinoco mouth, Guyana, Surinam south to Ubatuba, near Santos, Brazil).



Habitat and Biology : Marine and coastal, apparently down to about 60 m, but also occurring in lagoons and off river mouths (e.g. the Orinoco), perhaps entering water of lowered salinity. Probably spawns in the sea.

Size : To 9 cm standard length.

Interest to Fisheries : None.

Local Names : -

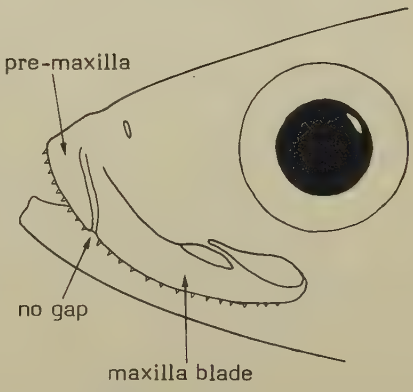
Literature : Hildebrand (i.e. FWNA, 1964 - note on spawning); Cervigón (1966 - habitat, fisheries), Matsuura (1973 - juveniles described and illustrated).

Neoopisthopterus Hildebrand, 1948

PRIST Neop

Neoopisthopterus Hildebrand, 1948, Smithson.misc.Collns, **110**(9):6 (type: Odontognathus tropicus Hildebrand).

Diagnostic Features : Small marine clupeoid fishes (to about 9 cm standard length), body elongate and somewhat compressed, with a sharp keel of scutes along belly. Mouth terminal; no hypo-maxilla; hind tip of pre-maxilla meets blade of maxilla; fine or minute teeth in jaws. Pelvic fins absent; anal fin long, with about 40 to 50 finrays. Most closely resembles Chirocentrodon in all respects, but that has canine-like teeth and pelvic fins present. All other similar pristigasterids either have pelvic fins or possess a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla blade (Pliosteostoma).



Biology, Habitat and Distribution : Marine and coastal, approaching river mouths, thus perhaps tolerating lowered salinities. Atlantic and Pacific sides of Central and South America.

Interest to Fisheries : Little or none.

Species : Authors have recognized an Atlantic and a Pacific species, distinguished almost solely on gillraker and anal finrays counts:

N. cubanus Hildebrand, 1948, western central Atlantic
N. tropicus (Hildebrand, 1946), eastern central Pacific.

Remarks : Neoopisthopterus hardly differs from Chirocentrodon in all but the absence of canine-like teeth and pelvic fins, but these characters occur consistently in all adults of the Pacific N. tropicus and presumably do so also in the Atlantic N. cubanus (overlaping the northern range of Chirocentrodon), which seems to be known only from small specimens.

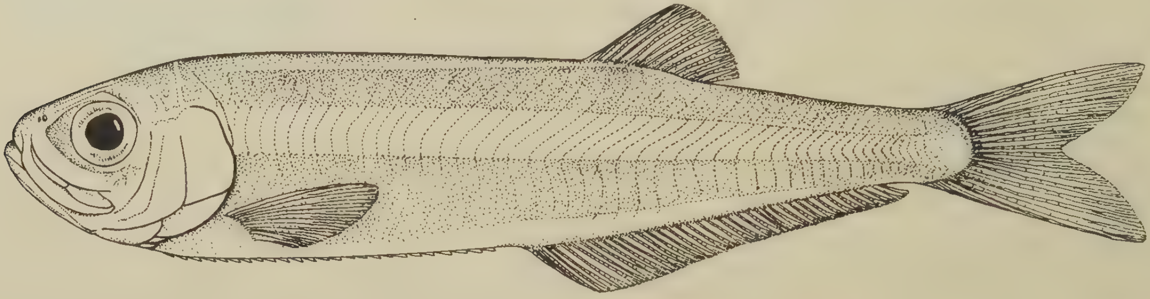
Neoopisthopterus cubanus Hildebrand, 1948

PRIST Neop 1

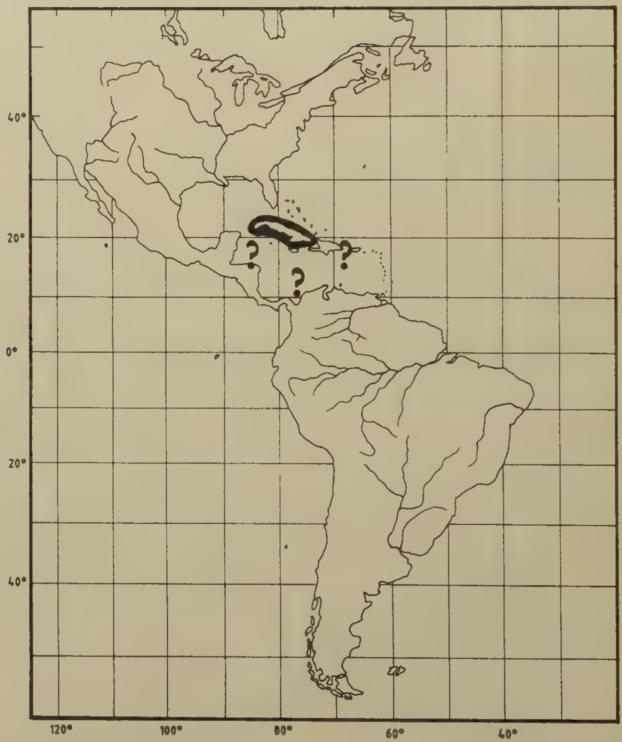
Neoopisthopterus cubanus Hildebrand, 1948, *Smithson.misc.Collns*, **110**(9):7, figs 3-4 (Havana, Cuba).

Synonyms : *Neoopisthopterus cubanus* - FWNA, 1964:436, fig. 112 (Havana, Cuba).

FAO Names : En - Cuban longfin herring.



Diagnostic Features : Body elongate, moderately compressed, its depth about 17 to 22% of standard length, belly with 23 to 28 scutes. Mouth terminal, lower jaw not strongly projecting; hind tip of maxilla meets lower bulge of maxilla blade and is overlapped by it; teeth very small or minute; lower gillrakers 17 or 18. Dorsal fin well behind midpoint of body; pelvic fins absent; anal fin long, with 39 to 43 finrays, its origin before dorsal fin origin. The Pacific *N. tropicus* has more gillrakers (18 to 21) and more anal finrays (43 to 48). Closely resembles *Chirocentrodon bleekerianus* in general form and shape of head and jaws, but that species has canine-like teeth and pelvic fins. Similar pristigasterids have the lower jaw strongly projecting; similar clupeids have less than 30 anal finrays.



Geographical Distribution : Western central Atlantic (Cuba; probably more widespread).

Habitat and Biology : Marine, coastal. More data needed.

Size : Unknown, but probably to about the same size as *N. tropicus*, i.e. 9 cm standard length.

Interest to Fisheries : Probably none.

Local Names : -

Literature : -

Remarks : Appears to be uncommon; more specimens may blur its distinction from *N. tropicus*.

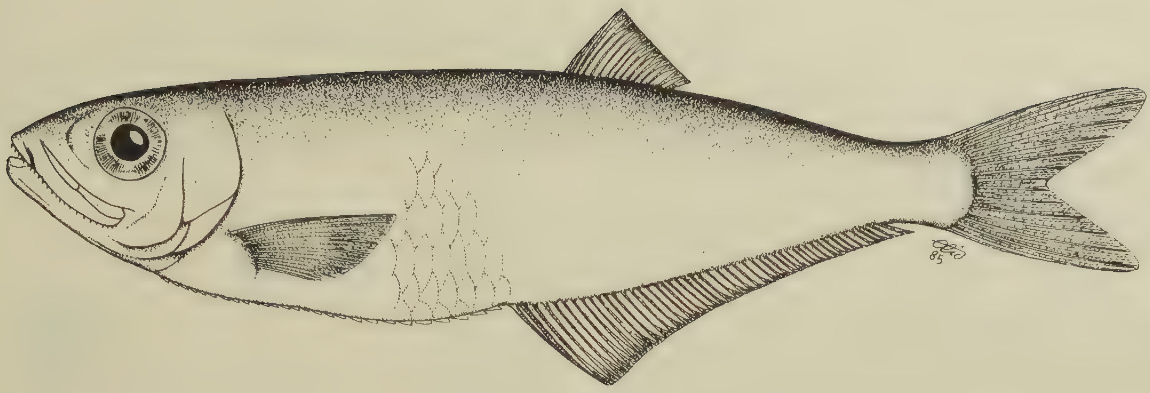
Neoopisthopterus tropicus (Hildebrand, 1946)

PRIST Neop 2

Odontognathus tropicus Hildebrand, 1946, *Bull.U.S.natn.Mus.*, (189):94, fig. 19 (Puerto Pizarro, Peru, also Panama Bay).

Synonyms : *Neoopisthopterus tropicus* - FWNA, 1964:436 (compared with *N. cubana*); Peterson, 1956:184 (Chira Island flats and Barranca Bay, Gulf of Nicoya, Costa Rica).

FAO Names : En - Tropical longfin herring.



Diagnostic Features : Body elongate, moderately compressed, its depth about 25 to 27% of standard length, belly with around 26 scutes. Mouth terminal, lower jaw not strongly projecting; hind tip of maxilla meets lower bulge of maxilla blade and is overlapped by it; teeth very small or minute; lower gillrakers 18 to 21. Dorsal fin well behind midpoint of body; pelvic fins absent; anal fin long, with 43 to 48 finrays, its origin before dorsal fin origin. A silver band along flank. The Atlantic N. cubanus has fewer gillrakers (17 or 18) and fewer anal finrays (39 to 43). Similar pristigasterids have a toothed hypo-maxillary bone between hind tip of pre-maxilla and lower bulge of maxilla (Pliosteostoma lutipinnis) or lower jaw prominent and mouth directed obliquely upward (Odontognathus, Opisthopterus). Similar clupeids have less than 30 anal finrays.

Geographical Distribution : Eastern central Pacific (Río Mayo, Gulf of California, Costa Rica, Panama Bay and south to Gulf of Guayaquil, Peru).

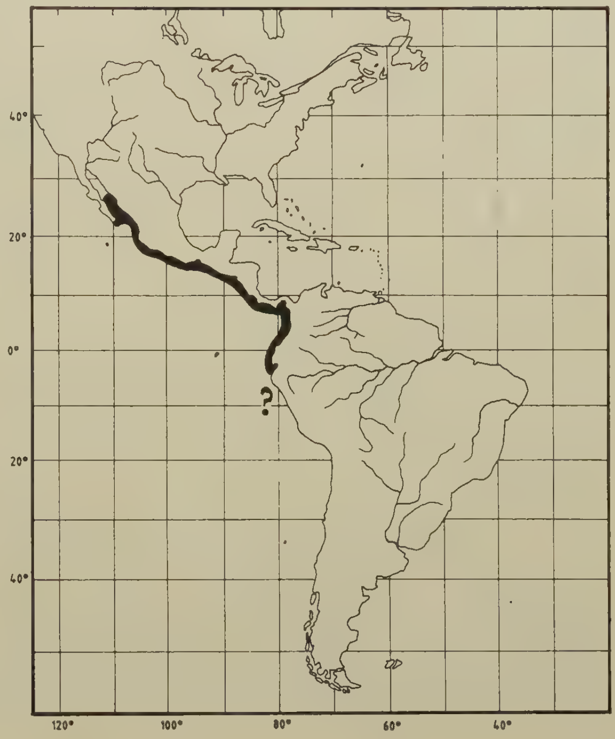
Habitat and Biology : Marine, coastal, occurring off river mouths (e.g. Río Mayo) thus perhaps tolerating lowered salinities. Feeds on planktonic crustaceans. An extended spawning period off Costa Rica (Peterson, 1956).

Size : To 9 cm standard length.

Interest to Fisheries : Probably little or none.

Local Names :

Literature : Peterson (1956 - brief notes on food and maturity).



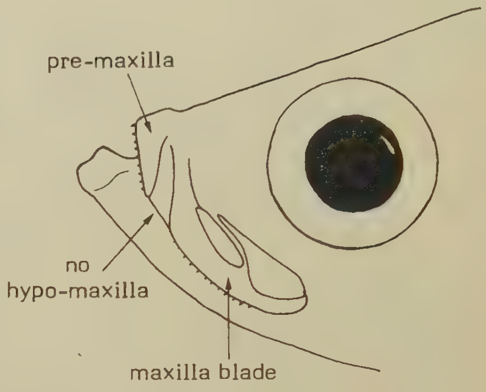
Opisthopterus Gill, 1861

PRIST Opis

Formerly CLUP Opis

Opisthopterus Gill, 1861, Proc.Acad.nat.Sci.Philad.:38 (type: Pristigaster tartoor Valenciennes = Pristigaster tardoore Cuvier).

Diagnostic Features : Moderate-sized marine or estuarine clupeoid fishes (to about 20 cm standard length), body rather elongate and strongly compressed, belly with a sharp keel of scutes. Eye large; lower jaw projecting, mouth directed obliquely upward; upper jaw short, not reaching back beyond about eye centre; no toothed hypo-maxilla between hind tip of pre-maxilla and blade of maxilla; jaw teeth small, usually with a distinct gap at centre of upper jaw; lower gillrakers 17 to 28. Dorsal fin small, its origin much behind midpoint of body; pelvic fins absent; anal fin long, more than 50 finrays, its origin well before that of dorsal fin. Scales easily lost, about 45 to 60 in lateral series. The long anal fin and elongate body easily distinguishes this genus from other pristigasterids except the Indo-Pacific Raconda (which lacks a dorsal fin) and the New World Odontognathus (maxilla long, to or beyond gill opening), Pliosteostoma (toothed hypo-maxilla present) and Neoopisthopterus (less than 50 anal finrays, tip of pre-maxilla reaches to blade of maxilla without a ligamentous gap).



Biology, Habitat and Distribution : Coastal, marine and estuarine fishes, probably schooling, able to tolerate at least brackish conditions. Found in tropical waters of the Indo-West Pacific and in the eastern central Pacific (but not along the Atlantic coasts of the Americas).

Interest to Fisheries : A small contribution to clupeoid catches, but no special fisheries.

Species : The 2 Indo-Pacific species were revised by Wongratana (1980), but there has been no comparable study of the 4 New World species:

Eastern Central Pacific

- O. dovii (Günther, 1868), California to Peru
- O. effulgens (Regan, 1903), Ecuador
- O. equitorialis Hildebrand, 1946, Honduras to Peru
- O. macrops (Günther, 1866), Panama.

Indo-Pacific

- O. tardoore (Cuvier, 1829), northern Indian Ocean to Indonesia
- O. valenciennesi Bleeker, 1872, China to Indonesia.

Remarks : The separation of Indo-Pacific from eastern Pacific species without any intermediate Atlantic species is a unique distributional pattern amongst clupeoids. The two Indo-Pacific species have been well studied, but the four Pacific species have not been revised since Norman (1923); they have been separated on gillraker counts and positions of dorsal and anal fin origins, but much more material should be studied before O. effulgens and O. macrops can be considered distinct from the apparently wide-ranging O. dovii and O. equitorialis.

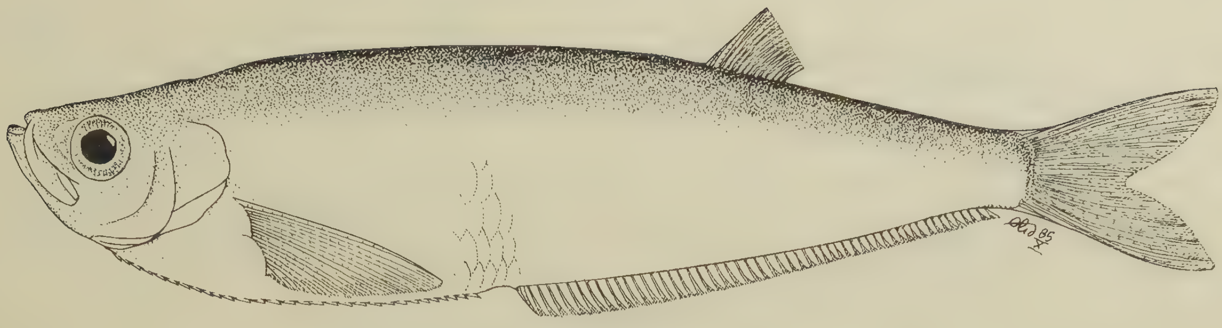
Opisthopterus dovii (Günther, 1868)

PRIST Opis 3

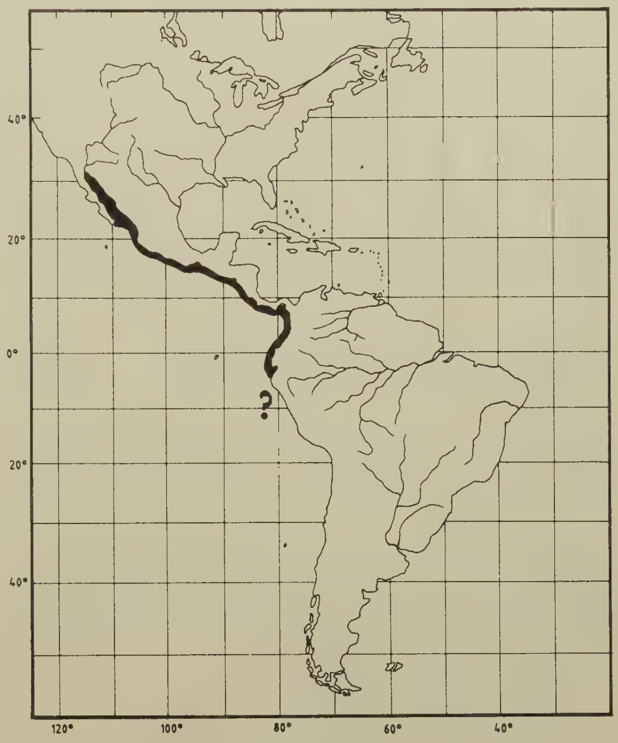
Pristigaster dovii Günther, 1868, Cat.Fish.Brit.Mus., 7:461 (Panamá; replacement name for Pristigaster argenteus Günther, 1866).

Synonyms : Pristigaster argenteus Günther, 1866:603 (Panama; preoccupied by Pristigaster argenteus Schinz, 1822 = Pristigaster cayana); Meek & Hildebrand, 1923:192, pl. 15, fig. 1 (labelled Odontognathus panamensis) (Chame Point, Balboa tidepools and Panama Market); Peterson, 1956:181 (Gulf of Nicoya, Costa Rica); Chirichigno, 1962:4, fig. 2 (photo) (Puerto Pizarro, Pta Mal Pelo, Peru); Cobo & Massay, 1969:7 (Ecuador, listed).

FAO Names : En - Dove's longfin herring.



Diagnostic Features : Body elongate and strongly compressed, its depth about 30% of standard length, belly with about 29 scutes. Lower jaw projecting, mouth pointing obliquely upward; no hypo-maxilla; lower gillrakers 15 to 19. Pectoral fin a little longer than head; dorsal fin origin nearer to caudal fin base than to vertical from pectoral fin base by 1½ eye diameters (or behind midpoint of body by 2 and 1/4 eye diameters); anal fin long, with 55 to 62 finrays, its origin much nearer to snout tip than to caudal fin base. Closely resembles Opisthopterus equitorialis, which has more gillrakers (21 to 25) and a silver band on flank, and O. effulgens, which has the anal fin origin equidistant between front margin of eye and caudal fin base (also, only 15 gillrakers); O. macrops has the dorsal fin origin equidistant between caudal fin base and pectoral fin base. Species of Odontognathus have a long upper jaw (to gill cover; cf. to below eye). Pliosteostoma lutipinnis has a distinct toothed hypo-maxilla between the hind tip of the pre-maxilla and the lower bulge of the maxilla blade. Neoopisthopterus tropicus has 50 or fewer anal finrays. Other clupeoids are more deep-bodied or the mouth is terminal or inferior.



Geographical Distribution : Pacific coasts of central and South America (Rio Muerto in Gulf of California southward to Panamá Bay; also Gulf of Guayaquil, Peru).

Habitat and Biology : Marine, coastal, perhaps entering water of lowered salinity. More data needed.

Size : To 19.6 cm standard length.

Interest to Fisheries : Probably enters artisanal fisheries.

Local Names : ECUADOR: Chaparra.

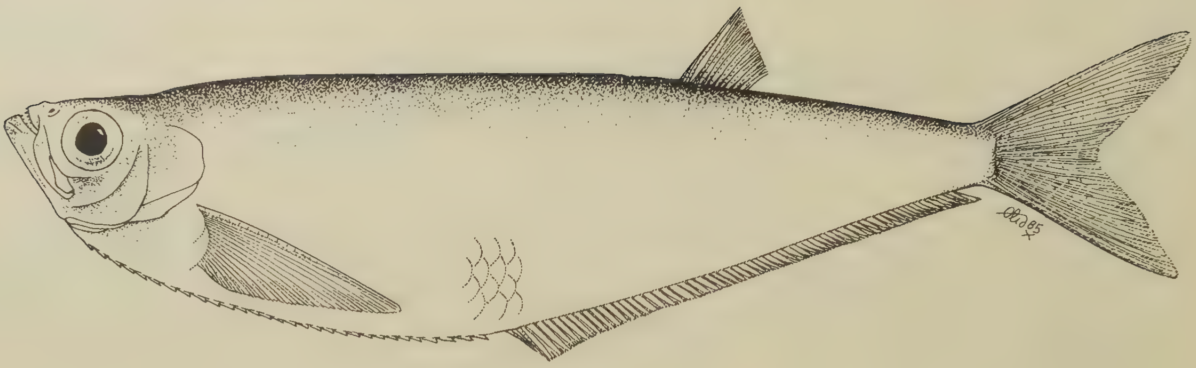
Opisthopterus effulgens (Regan, 1903)

PRIST Opis 4

Pristigaster (Opisthopterus) effulgens Regan, 1903, Ann.Mag.nat.Hist., (7)**12**:621 (Río Vaqueira, northwest Ecuador).

Synonyms : Opisthopterus effulgens - Norman, 1923:13 (the type only).

FAO Names : En - Vaqueira longfin herring.



Diagnostic Features : Body elongate and strongly compressed, its depth about 26 to 30% of standard length, belly with about 29 scutes. Lower jaw projecting, mouth pointing obliquely upward; no hypo-maxilla; lower gillrakers about 15. Pectoral fin a little longer than head; dorsal fin origin nearer to caudal fin base than to vertical from pectoral fin base by 1 eye diamter (or behind midpoint of body by 2 and 3/4 eye diameters); anal fin long, with 65 finrays, its origin about equidistant between caudal fin base and front margin of eye. Other Pacific species of Opisthopterus have the anal fin origin nearer to the snout than to the caudal fin base, also more lower gillrakers (17 to 25). Species of Odontognathus have a long upper jaw (to gill cover; cf. to below eye). Pliosteostoma lutipinnis has a distinct toothed hypo-maxillary bone between the hind tip of the pre-maxilla and the lower bulge of the maxilla. Neoopisthopterus tropicus has 50 or fewer anal finrays. Other clupeoids are more deep-bodied or the mouth is terminal or inferior.

Geographical Distribution : Pacific coasts (or rivers) of Central America (known only from the Río Vaqueira, northwest Ecuador).

Habitat and Biology : Perhaps riverine, or merely entering rivers or estuaries from the sea. More specimens and data needed.

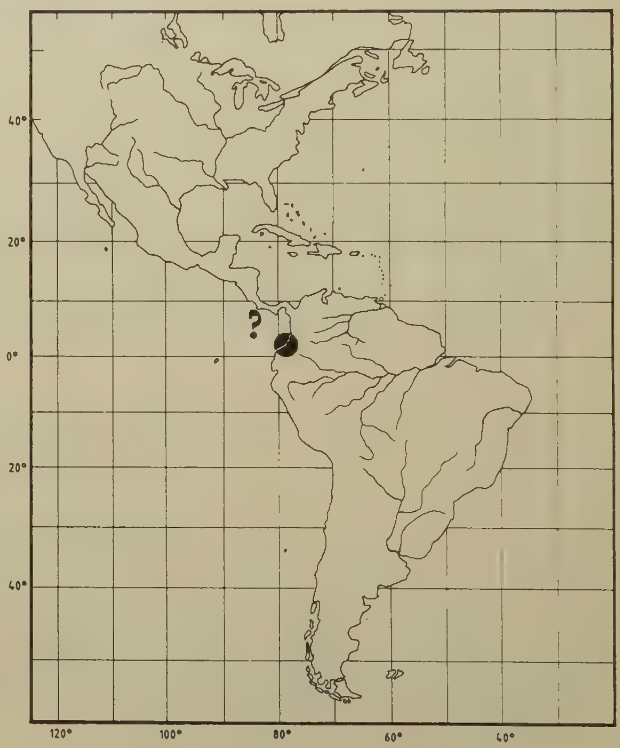
Size : To 20.5 cm standard length.

Interest to Fisheries : Probably enters artisanal fisheries.

Local Names : -

Literature : -

Remarks : The low gillraker count and rather posterior anal fin origin seem to be distinctive, but more specimens needed.



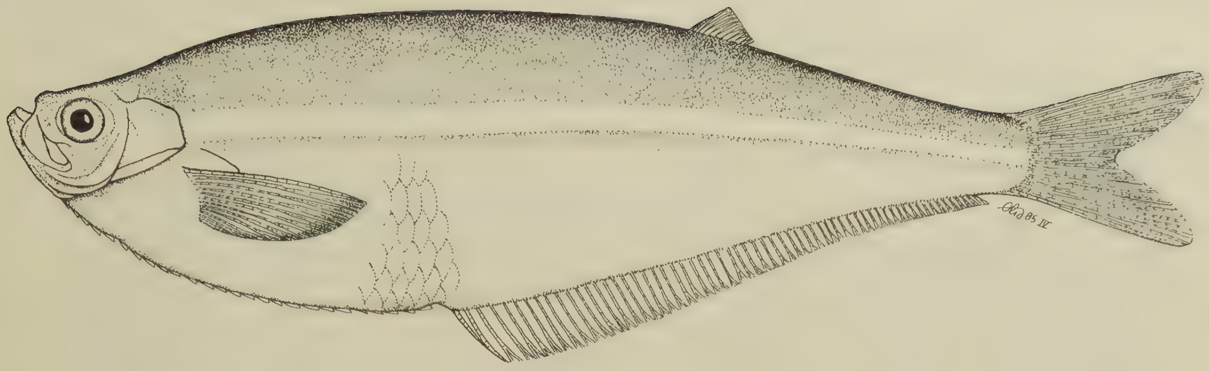
Opisthopterus equitorialis Hildebrand, 1946

PRIST Opis 5

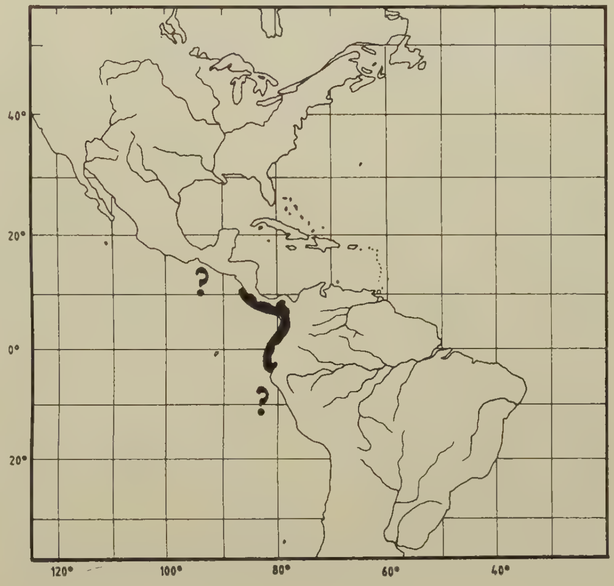
Opisthopterus equitorialis Hildebrand, 1946, Bull.U.S.natn.Mus., (189):93, fig. 18 (Puerto Pizarro, Gulf of Guayaquil, Peru).

Synonyms : Opisthopterus equitorialis - Peterson, 1956:182 (Gulf of Nicoya, Costa Rica); Cobo & Massay, 1969:7 (Ecuador, listed).

FAO Names : En - Equitorial longfin herring.



Diagnostic Features : Body elongate and strongly compressed, its depth about 28 to 30% of standard length, belly with 26 to 28 scutes. Lower jaw projecting, mouth pointing obliquely upward; no hypo-maxilla; lower gillrakers 21 to 25; dorsal fin origin nearer to caudal fin base than to vertical from pectoral fin base by about 2 eye diameters (or behind midpoint of body by about 3 eye diameters); anal fin long, with 56 to 62 finrays, its origin much nearer to snout tip than to caudal fin base. Other Pacific species of Opisthopterus have 20 or fewer lower gillrakers. Odontognathus panamensis has a long upper jaw (to gill cover; cf. to below eye). Pliosteostoma lutipinnis has a distinct toothed hypo-maxillary bone between the hind tip of the pre-maxilla and the lower bulge of the maxilla blade. Neoopisthopterus tropicus has 50 or fewer anal finrays. Other clupeoids are more deep-bodied or the mouth is terminal or inferior.



Geographical Distribution : Pacific coasts of Central and South America (Gulf of Fonseca, Honduras to Gulf of Guayaquil, Peru).

Habitat and Biology : Marine, coastal, perhaps entering water of lowered salinity. More data needed.

Size : To 14.6 cm standard length.

Interest to Fisheries : Probably enters artisanal fisheries.

Local Names : -

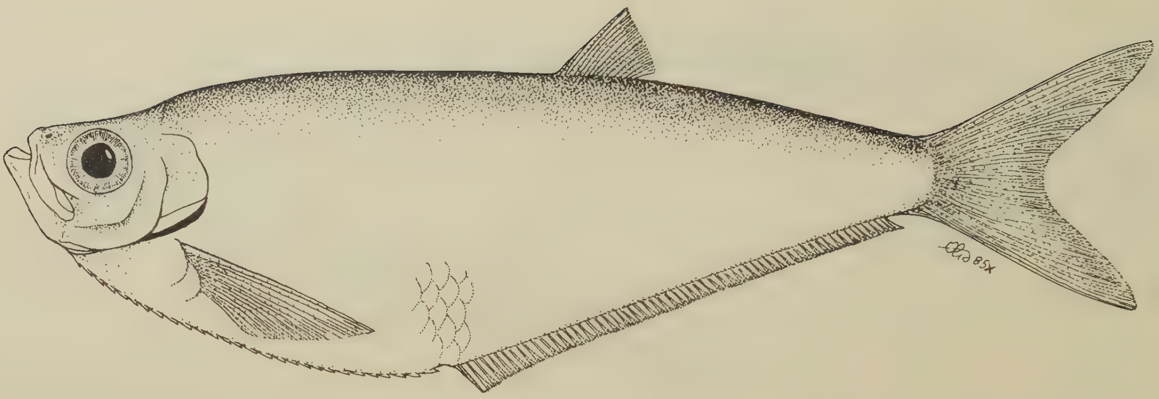
Opisthopterus macrops (Günther, 1866)

PRIST Opis 6

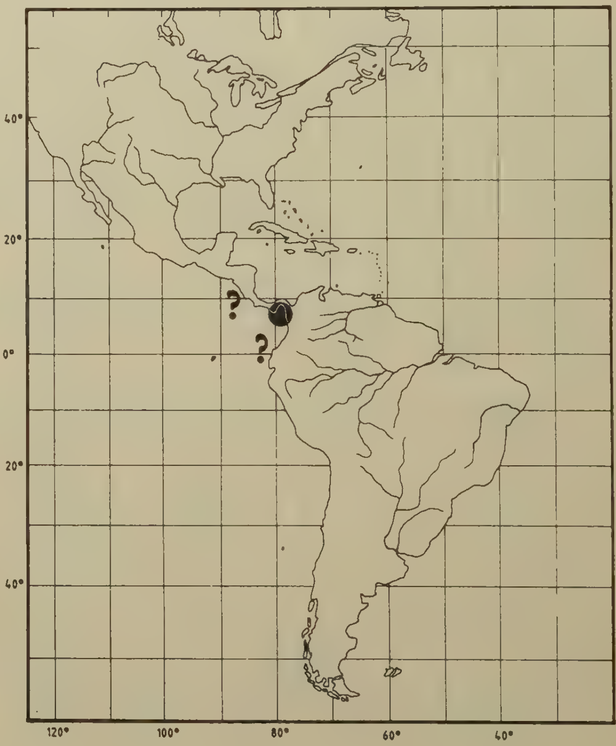
Pristigaster microps Günther, 1866, Proc.zool.Soc.Lond.:603 (Panama).

Synonyms : Opisthopterus macrops - Norman, 1923:11 (Panama); Meek & Hildebrand, 1923:14 (Panama, compiled); Hildebrand, 1946:94 (compared with O. equitorialis, meristics, etc.).

FAO Names : En - Bigeyed longfin herring.



Diagnostic Features: Body moderately deep and strongly compressed, its depth about 35% of standard length, belly with about 28 scutes. Lower jaw projecting, mouth pointing obliquely upward; no hypo-maxilla; lower gillrakers 19 or 20. Pectoral fin a little longer than head; dorsal fin origin about equidistant between caudal fin base and vertical from pectoral fin base (or 1 and 1/4 eye diameters behind midpoint of body); anal fin long, with about 60 finrays, its origin nearer to snout tip than to caudal fin base. Other Pacific species of *Opisthopterus* have the dorsal fin base nearer to the caudal fin base than to the pectoral fin base, also more gillrakers in *O. equitorialis* (21 to 25). *Pliosteostoma lutipinnis* has a distinct toothed hypo-maxilla between the hind tip of the pre-maxilla and the lower bulge of the maxilla blade. *Neoopisthopterus tropicus* has 50 or fewer anal finrays. Other clupeoids are more deep-bodied or the mouth is terminal or inferior.



Geographical Distribution: Pacific coasts of Central America (Panama Bay).

Habitat and Biology: Marine, coastal. More data needed.

Size: To 17 cm standard length.

Interest to Fisheries: Probably enters artisanal fisheries.

Local Names: -

Literature: See under Synonyms.

Remarks: Apparently distinct from the other three Pacific species because of the rather advanced dorsal fin, but more specimens needed.

Opisthopterus tardoore (Cuvier, 1829)

PRIST Opis 1

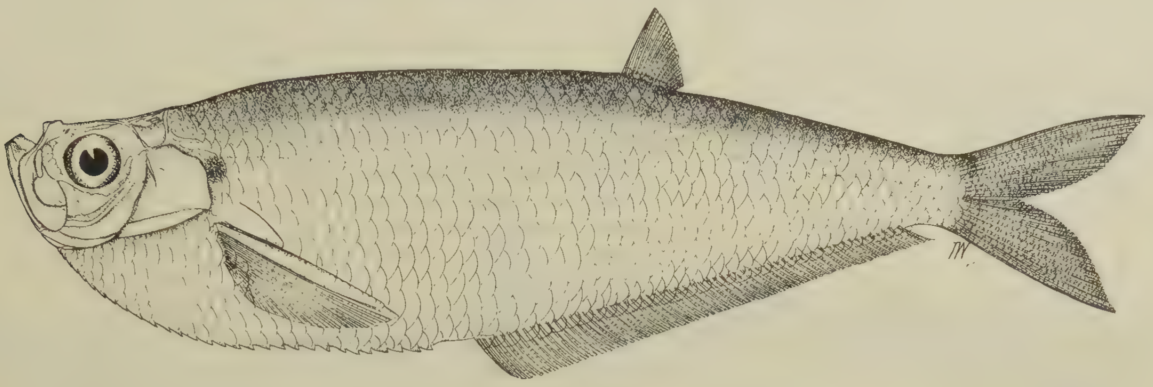
Formerly CLUP Opis 1

Pristigaster tardoore Cuvier, 1829, *Règne animal*, 2nd ed., **2**:381 (on Tartoore of Russell, 1803, Vizagapatnam, India).

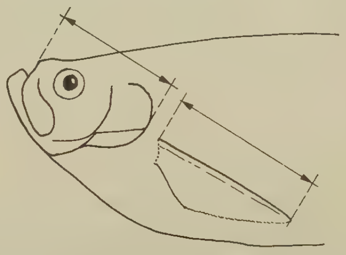
Synonyms: *Pristigaster elongata*, Swainson, 1838:278 (on Tartoore); *Pristigaster indicus* Swainson, 1839:294 (on Tartoore); *Pristigaster tartoor* Valenciennes, 1847:328 (Pondicherry, Malabar); *Opisthopterus macrognathus* Bleeker, 1866:25 (Jakarta); *Opisthopterus tartus* Zugmayer, 1913:9 (Oman); *Opisthopterus tardoore*

- Fowler, 1941:663 (Calicut, India and Padang, Sumatra; Java, but Hong Kong specimens were perhaps O. valenciennesi); Whitehead et al., 1966:104 pl. 13, fig. 3 (Bleeker's fig.) (key, types of macrognathus); Whitehead, 1973b:215, fig. 39 (key, synon., refs); Wongratana, 1980:216, pls 179, 180 (revision).

FAO Names : En - Tardoore.

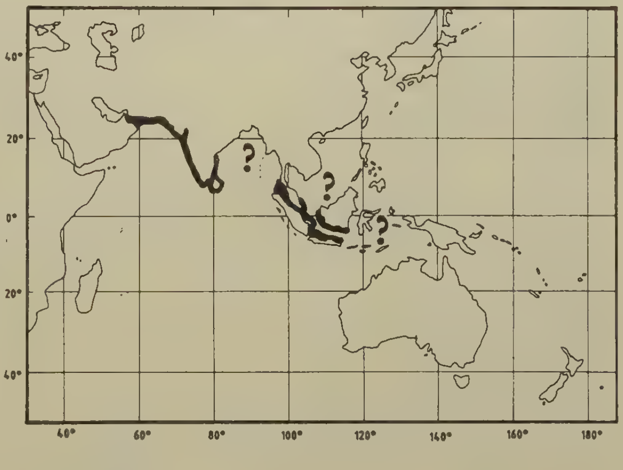


Diagnostic Features : Body elongate and strongly compressed, its depth 27 to 33% of standard length, belly concave in front, with 29 to 35 scutes. Mouth pointing obliquely upward; lower gillrakers 22 to 28, increasing with size of fish. Pectoral fin with 12 to 14 finrays, its length 21 to 26% of standard length (usually about equal to head length or greater); dorsal fin small, well behind midpoint of body; pelvic fins absent; anal fin long, with 51 to 63 finrays, its origin well before dorsal fin origin. Scales in lateral series 46 to 51. Closely resembles O. valenciennesi, which is more slender (depth 24 to 29% of standard length), and has a shorter pectoral fin with more finrays (length 14 to 17% of standard length, thus shorter than head; 15 to 17 finrays). Raconda russeliana is superficially similar, but lacks a dorsal fin and has more anal finrays (81 to 93 finrays). Other pristigasterids have pelvic fins and a shorter anal fin. See CLUP Opis 1, Fishing Area 51, also Fishing Areas 57, 71.



pectoral fin equal or longer than head

Geographical Distribution : Indian Ocean (from the Gulf of Oman to at least Madras, perhaps to the north and along the coasts of Burma, certainly at Penang), Singapore and Java Sea (Sumatra), Java, Kalimantan).



Habitat and Biology : Marine, close to shore, also entering estuaries (e.g. Aluhaluh on Barito River, Kalimantan). Feeds on mysids, Pseudodiaptomus and copepod eggs, also prawns and other small crustaceans, bivalve eggs and larvae, amphipods and small fishes. Spawns in late February or early March to July or August (around Karwar, India).

Size : To 18 cm standard length.

Interest to Fisheries : No special fishery, but is caught with other clupeoids in shore seines (e.g. at Karwar from May to September); also caught with lift nets and trawls in shallow waters.

Local Names : INDIA: Tardoor, Tartoor; INDONESIA: Kentut (Jakarta).

Literature : John (1951 - juveniles); Radhakishnan (1961, 1967, 1968a, b - general biology, maturation and spawning, racial variation); Basheerudin & Nayar (1962 - juveniles); Bensam (1968 - embryos and larvae).

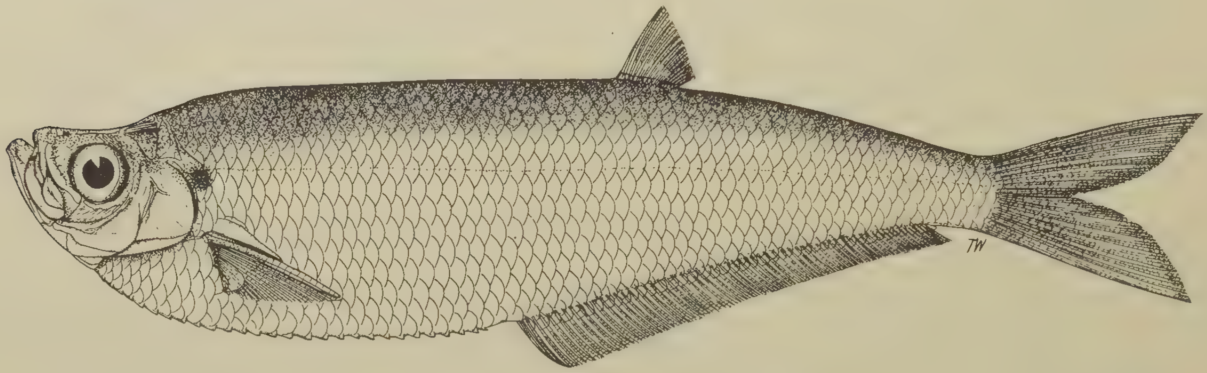
Opisthopterus valenciennesi Bleeker, 1872

PRIST Opis 2

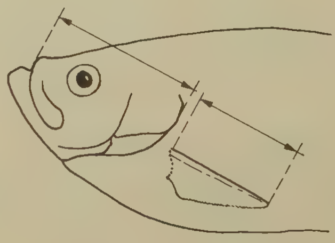
Opisthopterus valenciennesi Bleeker, 1872, Atlas ichthyol.Ind.Néerland., **6**:124 (replacement name for Opisthopterus tartoor of previous page, preoccupied by Pristigaster tartoor Valenciennes = Opisthopterus tardoore, the other species in the genus; Jakarta, Singapore).

Synonyms : Opisthopterus tartoor Bleeker, 1872:124 (see above); Opisthopterus tardoore:Chu, Tchang & Chen, 1963:106, fig. 80 (China); Opisthopterus valenciennesi - Fowler, 1941:664 (compiled; key, synon.); Whitehead et al., 1966:106, pl. 14, fig. 1 (Bleeker's fig.) (key, types of O. valenciennesi); Wongratana, 1980:215, pls 177, 178 (revision).

FAO Names : En - Slender tardoor.



Diagnostic Features : Body very elongate and strongly compressed, its depth 24 to 29% of standard length, belly concave in front, with 30 to 33 scutes. Mouth pointing obliquely upward; lower gillrakers 23 to 25. Pectoral fin with 15 to 17 finrays, its length 14 to 17% of standard length (thus distinctly shorter than head); dorsal fin small, well behind midpoint of body; pelvic fins absent; anal fin long, with 54 to 65 finrays, its origin well before dorsal fin origin. Scales in lateral series 51 to 56. Closely resembles O. tardoore, which has a deeper body (27 to 33% of standard length) and a longer pectoral fin with fewer finrays (length 21 to 26% of standard length, thus about equal to head length or longer; 12 to 14 finrays). Raconda russeliana is superficially similar, but lacks a dorsal fin and has more anal finrays (81 to 93 finrays). Other pristigasterids have pelvic fins and a shorter anal fin.



head longer than pectoral fin

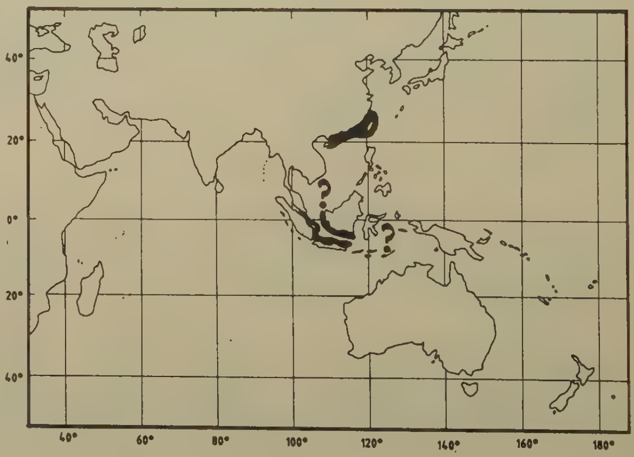
Geographical Distribution : Indo-West Pacific (Java Sea, Singapore north to East China Sea at Foochow).

Habitat and Biology : Along shores and in estuaries; probably similar to O. tardoore, but more specimens and data needed.

Size : To 20 cm standard length.

Interest to Fisheries : Probably contributes to artisanal fisheries for clupeoids.

Local Names : INDONESIA: Lipiram (if O. macrognathus of Weber & de Beaufort, 1913:96 is this species).



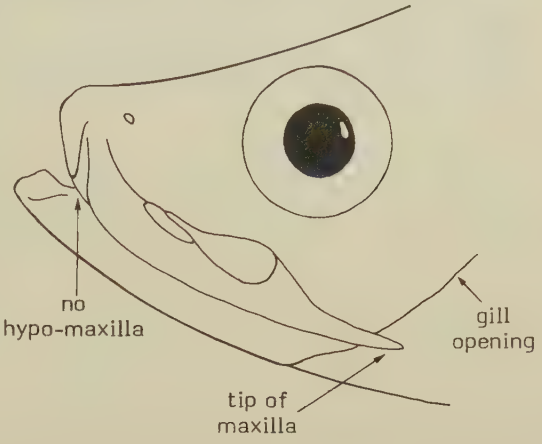
Odontognathus Lacepède, 1800

PRIST Odont

Formerly CLUP Odont

Odontognathus Lacepède, 1800, Hist.nat.Poiss., 2:220 (type: Odontognathus mucronatus Lacepède). Gnathobolus Schneider, 1801, Syst.Ichthyol.Bloch.:556 (type: Odontognathus mucronatus Lacepède).

Diagnostic Features: Moderate-sized marine, estuarine and freshwater clupeoids (to about 17 cm standard length), body elongate and highly compressed, with a sharp keel of scutes along belly. Eye fairly large; lower jaw somewhat projecting, mouth directed obliquely upward; upper jaw long, reaching to or beyond gill opening; no toothed hypo-maxilla between hind tip of pre-maxilla and lower bulge of maxilla blade; jaw teeth small or minute, with a distinct toothless notch at centre of upper jaw. Gillrakers short and slender, 18 to 26 on lower part of arch. Dorsal fin small, well behind midpoint of body; pectoral fins large; pelvic fins absent; anal fin very long, with 55 to 85 finrays, its origin well in advance of dorsal fin. Closely resembles Pacific Opisthopterus, in which the upper jaw barely reaches to eye centre, as also in Neoopisthopterus, which has a shorter anal fin (50 finrays or less). Chirocentrodon has canine teeth and other clupeoids are deeper-bodied.



Biology, Habitat and Distribution: Marine and inshore, but penetrating 10 km or more up rivers in some cases. Atlantic and Pacific coasts and drainage of South and Central America.

Species: According to Whitehead (1973a:73), there are 3 species:

Atlantic

O. compressus Meek & Hildebrand, 1923, Panama to the Guianas
O. mucronatus Lacepède, 1800, Trinidad to Brazil

Pacific

O. panamensis (Steindachner, 1876), Honduras to Panama Bay.

Odontognathus compressus Meek & Hildebrand, 1923

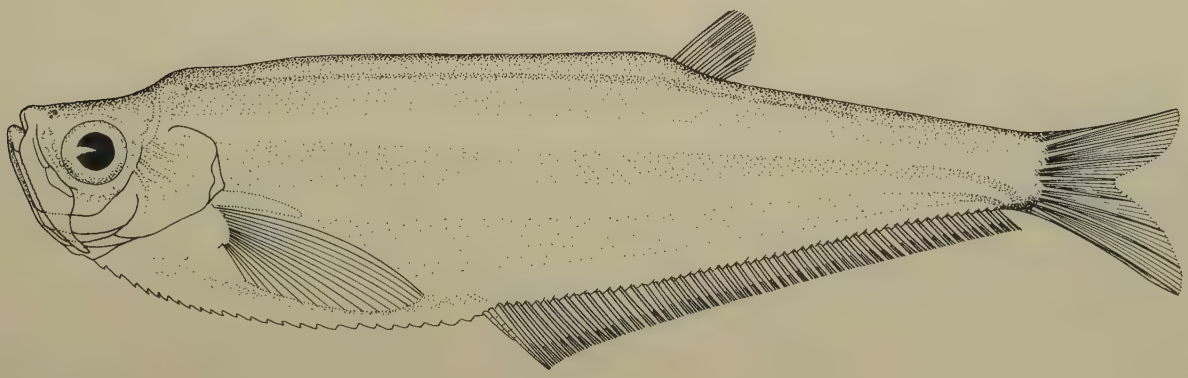
PRIST Odont 1

Formerly CLUP Odont 1

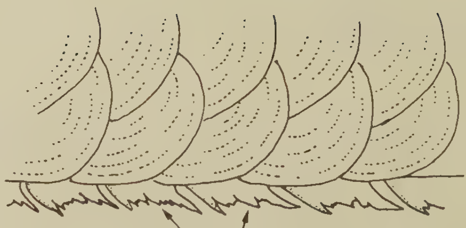
Odontognathus compressus Meek & Hildebrand, 1923, Publs Field Mus.nat.Hist., 15(1):194 (Colón, Panama).

Synonyms: Odontognathus mucronatus:Valenciennes, 1847:91, fig. 611 (Cayenne, Surinam; misidentified); Odontognathus compressus - FWNA, 1964:433, fig. 110, 111 (Panama, Gulf of Venezuela); Cervigón, 1966:130 (Venezuela, compiled); Whitehead, 1973a:78, fig. 25 (Trinidad); Whitehead & Bauchot, in press (mucronatus of Valenciennes).

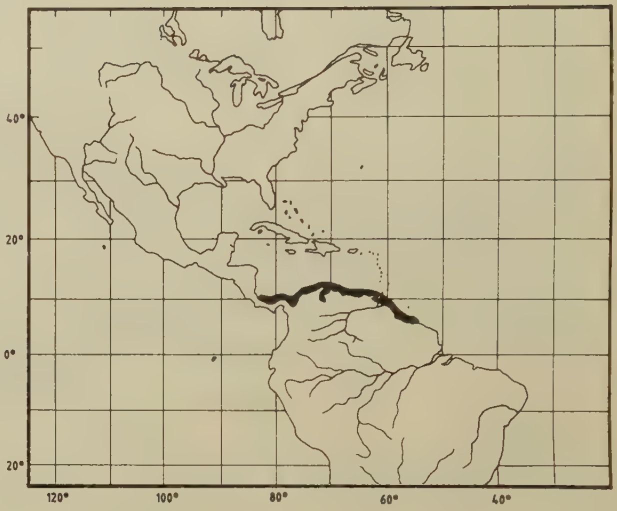
FAO Names: En - Caribbean longfin herring.



Diagnostic Features : Body long and compressed, with an uninterrupted keel of 24 to 28 scutes, the outer edges of the scutes distinctly serrated. Upper jaw broad at midpoint, tapering posteriorly, the tip reaching or surpassing gill opening. Pectoral fins large; pelvic fins absent; dorsal fin rather small, set far back on body; anal fin long, with 55 to 61 finrays. Resembles O. mucronatus (which it overlaps in Trinidad and Cayenne), which has smooth edged scutes with a gap below pectoral fin base, and more anal finrays (70 to 85); no other clupeoid in the area has so many anal finrays or such a long upper jaw (Neoopisthopterus, Chirocentrodon). See CLUP Odont 1, Fishing Area 31.



Geographical Distribution : Atlantic coasts and perhaps estuaries of Central and South America (Panama, coasts of Venezuela, Trinidad, Surinam or Cayenne - the mucronatus figured by Valenciennes, 1847).



Habitat and Biology : Coastal, inshore, probably entering estuaries, but more data needed.

Size : To at least 13 cm standard length.

Interest to Fisheries : Probably contributes to artisanal catches.

Local Names : -

Odontognathus mucronatus Lacepède, 1800

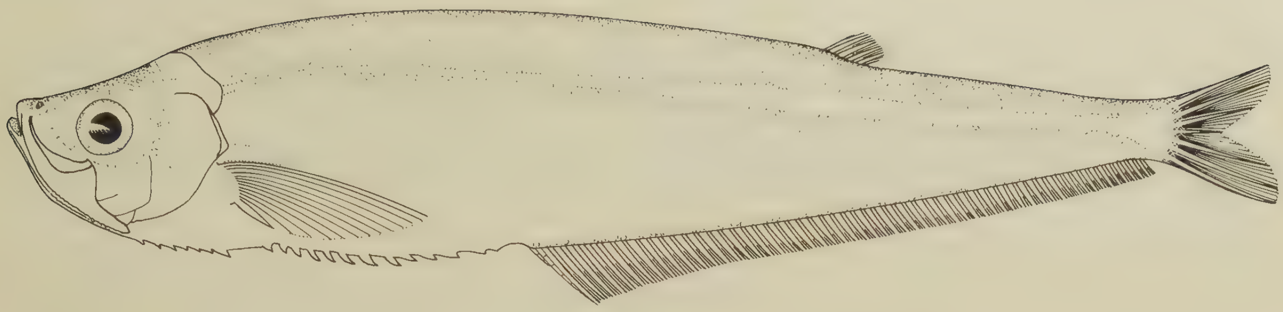
PRIST Odont 2

Formerly CLUP Odont 2

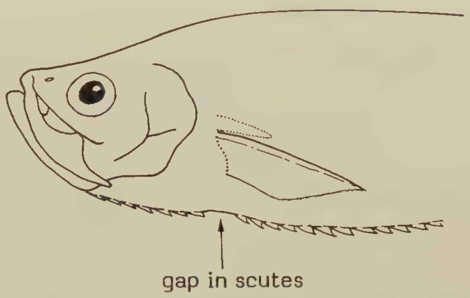
Odontognathus mucronatus Lacepède, 1800, Hist.nat.poiss., 2:220, pl. 7, fig. 2 (Cayenne).

Synonyms : Odontognathus aculeatus Schinz, 1822:300 (on Lacepède); Odontognathus mucronatus - FWNA, 1964:431, fig. 109 (Trinidad); Cervigón, 1966:131, fig. 55 (off Orinoco delta); Whitehead, 1967:104 (type of mucronatus); Idem, 1973a:73, figs 22-24 (Guayana, Surinam coasts and rivers); Figueiredo & Menezes, 1978:25, fig. 30 (Brazil, compiled); Uyeno, Matsuura & Fujii, 1983:94, fig. (colour photo) (Surinam); Whitehead & Bauchot, in press (type of mucronatus).

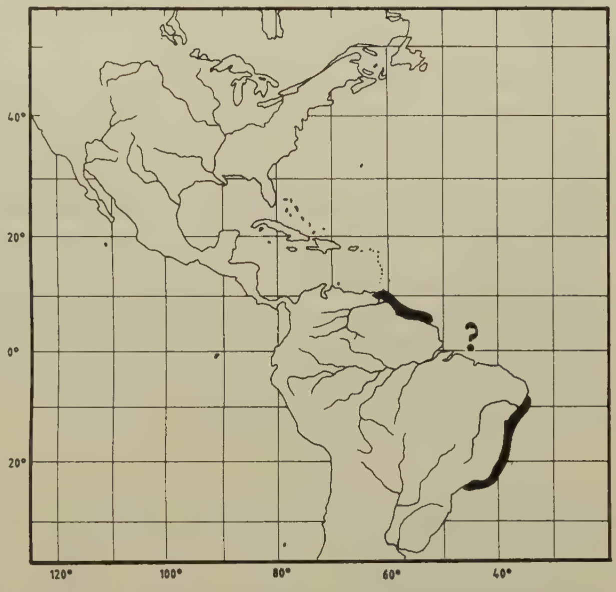
FAO Names : En - Guiana longfin herring.



Diagnostic Features : Body long and strongly compressed, with a keel of scutes along belly, but interrupted below pectoral fin base; scutes 7 or 8, then a gap, followed by 10 to 13, the outer edges of scutes smooth and not serrated. Upper jaw broad at midpoint, tapering posteriorly, the tip reaching or surpassing gill opening; no hypo-maxilla. Pectoral fins large; pelvic fins absent; dorsal fin very small, set far back on body; anal fin long, with 70 to 85 finrays. Resembles *O. compressus*, which has serrated outer edges to scutes with no gap below pectoral fin base and only 52 to 62 anal finrays; no other elongate clupeoid in the area has so many anal finrays or such a long upper jaw (*Neoopisthopterus*, *Chirocentrodon*). See CLUP Odont 2, Fishing Area 31



Geographical Distribution : Atlantic coasts and rivers of South America (Trinidad and the Guianas; then no records until southern Brazil, from Sergipe south to about Rio de Janeiro).



Habitat and Biology : Off coasts, trawled at down to 40 m, also close to shore, off river mouths, in estuaries and some distance up rivers in freshwater (e.g. up Coppename River near Wilhelmina Mts, Surinam). Possibly spawns in rivers.

Size : To 15, perhaps to 17 cm standard length.

Interest to Fisheries : No special fishery, but contributes to clupeoid catches in coastal waters.

Local Names : SURINAM: Giana-nishin (Uyeno, Matsuura & Fujii, 1983).

Literature : See under Synonyms.

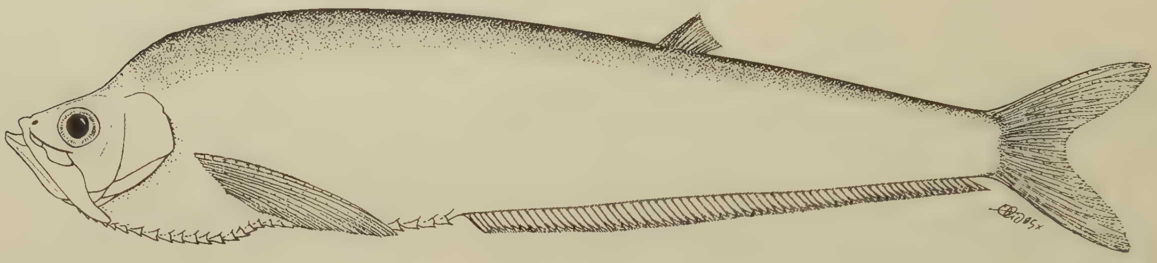
Remarks : The extension of the range to include southern Brazil is based on specimens in the Museu de Zoologia, São Paulo.

Odontognathus panamensis (Steindachner, 1876)

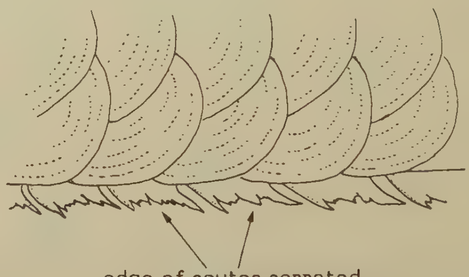
Pristigaster (Odontognathus) panamensis Steindachner, 1876, Sber.Akad.Wiss.Wien, **74**:72 (Panama); Idem, 1876, Ichthyol.Beitr., (5):24 (repeat).

Synonyms : Odontognathus panamensis - Meek & Hildebrand, 1923:194, but the illustration is Opisthopterus dovii (Chame Point, Panama); Norman, 1923:16 (Panama); Peterson, 1956:183 (Gulf of Nicoya, Costa Rica); Whitehead, 1971:27, fig. 3a, b (type of panamensis; key).

FAO Names : En - Panama longfin herring.

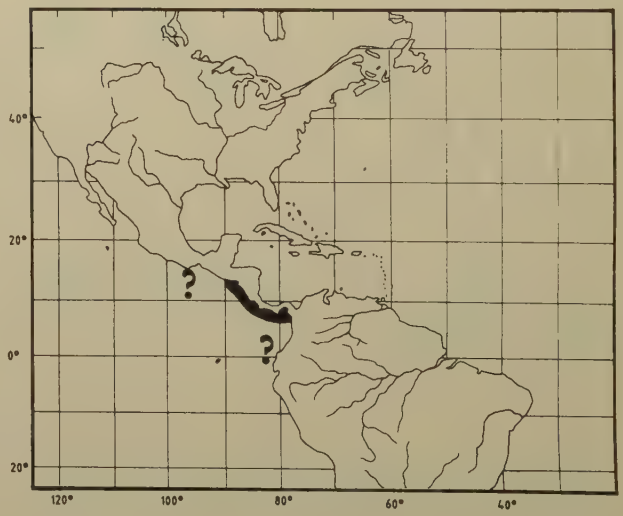


Diagnostic Features : Body long and compressed, with an uninterrupted keel of about 29 or 30 scutes, the outer edges of the scutes distinctly serrated. Upper jaw broad at midpoint, tapering posteriorly, the tip reaching or surpassing the gill opening; no hypo-maxilla. Pectoral fins large; pelvic fins absent; dorsal fin rather small, set far back on body; anal fin long, with 61 to 68 finrays. Resembles the Atlantic O. compressus, which has only 55 to 61 anal finrays and 24 to 28 scutes; also very similar to species of Opisthopterus, which have a short upper jaw, not reaching beyond eye. Pliosteostoma has a small toothed hypo-maxillary bone between the hind tip of the pre-maxilla and the lower bulge of the maxilla blade. Other clupeoids have a shorter anal fin.



edge of scutes serrated

Geographical Distribution : Pacific coasts and perhpas estuaries of central America (Gulf of Fonseca, Honduras to Panama; possibly it extends further south).



Habitat and Biology : Marine, inshore, perhaps like its congeners entering estuaries. Feeds on small crustaceans and fishes (Peterson, 1956).

Size : To 17 cm standard length.

Interest to Fisheries : Enters artisanal fisheries, but not in great numbers.

Local Names : -

Literature : Peterson (1956 - maturity, food).

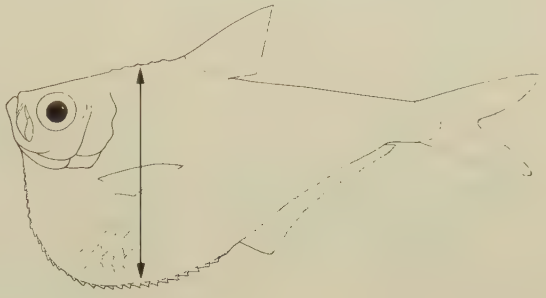
Pristigaster Cuvier, 1816

PRIST Prist

Pristigaster Cuvier, 1816, *Règne animal*, 1st ed., **2**:176 (descr., no species named); *Idem*, *ibid.*, **4**:pl. 10, fig. 3 (presumed type figured, but not named = *Pristigaster cayana* Cuvier, 1829); *Idem*, 1829, *Règne animal*, 2nd ed., **2**:321 (*P. tardoore* and *P. cayanus* listed); *Idem*, 1830, *ibid.*, **3**:pl. 12, fig. 3 (repeat of 1st ed., species still not named) (the problem of the type species is discussed by Whitehead, 1967:100, 101). *Pristogaster* Swainson, 1838, *Nat.Hist.Anim.*, **1**:266, fig. 57 (type: not indicated, but figure = *P. cayana* Cuvier); *Idem*, 1839, *ibid.*, **2**:294 (*P. indicus*, on Russell's *Tartoore* = *Clupea melastoma* Schneider, a species of *Ilisha*, and *P. martii* Agassiz = *P. cayana*).

Diagnostic Features : Relatively small freshwater clupeoid fishes (to 15 cm standard length) characterized by the enormously deep body and strongly convex belly profile. Mouth directed nearly upward; no toothed hypo-maxilla. Pelvic fins usually absent; anal fin long, with more than 40 finrays. No other clupeoid has such a deep body (at most to about 40% of standard length; cf. over 50% in *Pristigaster*).

Biology, Habitat and Distribution : Riverine, but apparently reaching to mouth of Amazon and thus perhaps able to tolerate some salinity. Known only from the Amazon drainage.



Interest to Fisheries : Little or none.

Species : Until recently, only a single species has been recognized, but there is some evidence (see Remarks under *P. cayana*) that a second species may be present:

P. cayana Cuvier, 1829, Amazon drainage.

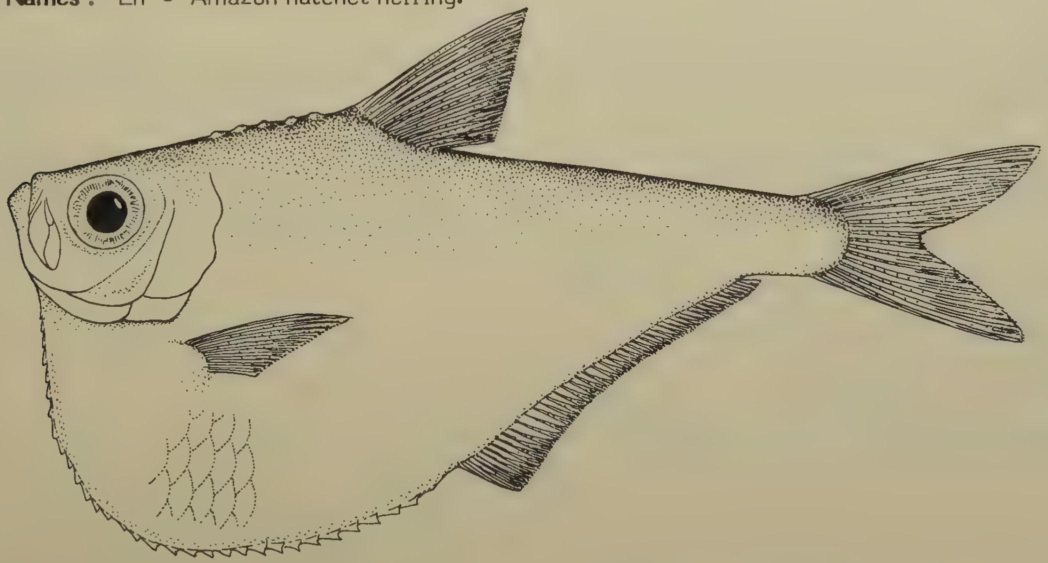
Pristigaster cayana Cuvier, 1829

PRIST Prist 1

Pristigaster cayanus Cuvier, 1829 (February or March), *Règne animal*, 2nd. ed., **2**:321 (footnote, name only, American seas); *Idem*, 1830, *ibid.*, **4**:pl. 10, fig. 3 (merely as *Pristigaster*).

Synonyms : *Pristigaster argenteus* Schinz, 1822:300 (on Cuvier's fig.; *nomen oblitum*); *Pristigaster lichtensteinii* Jarocki, 1822:332, fig. 3 (on Cuvier's fig., reproduced; for Jarocki's Polish ed. of the *Règne animal*, see Whitehead, 1982b; *nomen oblitum*); *Pristigaster triangularis* Stark, 1828:408 (on *Pristigaster* fig. in Cuvier, 1816:pl. 10, fig. 3; *nomen oblitum*); *Pristigaster martii* Agassiz, *in* Spix & Agassiz, 1829 (May or June):55, pl. 24a (Amazon); just post-dates *cayanus* by a month or so); *Pristigaster americanus* Guerin-Meneville, 1844:33, pl. 57, fig. 3 (Atlantic coast of South America); *Pristigaster phaeton* Valenciennes, 1847:338 (Amazon); *Pristigaster cayana* - FWNA, 1964:428, fig. 108 (synopsis); Whitehead, 1967:100, 102 (types of *cayana*, *phaeton*); Whitehead & Myers, 1971:487 (validity of *martii*); Whitehead, 1973a:85 (*triangularis* a *nomen oblitum*; synon.); Whitehead & Bauchot, in press (types of *cayana*, *phaeton*).

FAO Names : En - Amazon hatchet herring.



Diagnostic Features: Body extremely deep and compressed, its depth 50 to 60% of standard length, belly profile strongly convex (almost circular from throat to anus), with 30 to 33 scutes. Eye large; lower jaw projecting, mouth directed almost vertically upward; no toothed hypo-maxillary bone between hind end of premaxilla and lower bulge of maxilla blade. Pectoral fins high on body; pelvic fins usually absent, but present in some (see Remarks below); dorsal fin before midpoint of body; anal fin long, its origin behind dorsal fin base, with 45 to 54 finrays; upper caudal fin lobe ending in a filament in larger fishes. The deep body distinguishes it from other Amazon clupeoids (Pellona, Ilisha, etc.). Superficially, it resembles the deep-bodied gasteropelecine fishes, but these have a keel on the chest and no distinct bony scutes.

Geographical Distribution: Amazon drainage (from perhaps mouth of Rio Branco at Goiaçu, Rio Solimões, Rio Juruá and as far as the Río Ucayali in Peru fide Fowler, 1940:16).

Habitat and Biology: Riverine, perhaps entering slightly saline waters near mouth of Amazon (but this part of its range not well documented). Compared with the 'flying' characoid fishes (Gasteropelecus, Thoracocharax, etc.), the vertically aligned scute arms in Pristigaster and the rather small pectoral muscles show that flight by vibration of the pectoral fins is almost certainly impossible; since Pristigaster and Thoracocharax have been caught together (e.g. at Paraná do Mocambo near Parintins), is mimicry involved?

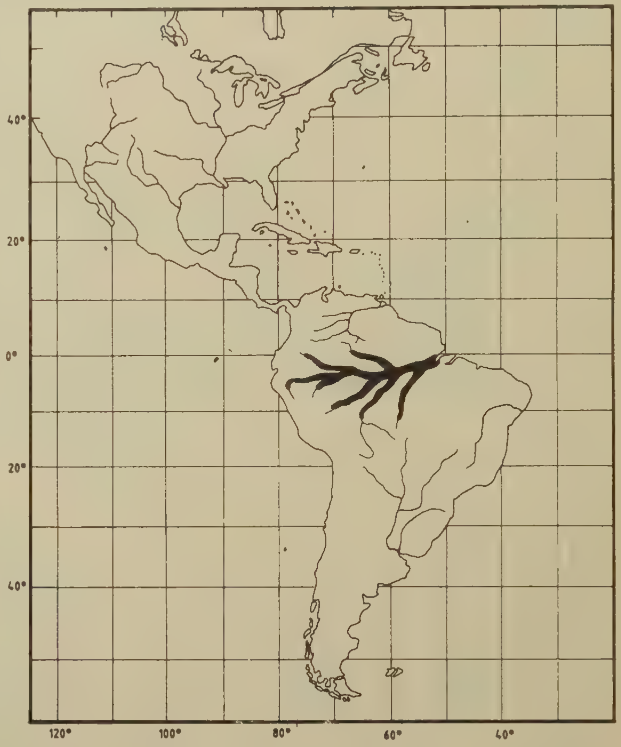
Size: To 14.4 cm standard length, usually about 7 to 10 cm.

Interest to Fisheries: Little or none.

Local Names: BRAZIL: Apapa.

Literature: See under Synonyms.

Remarks: Possibly there are two species, judging from specimens in the Museu de Zoológia, São Paulo:



A. Pelvic fins absent, lower gillrakers 22 to 24 (usually 23); Amazon from Rio Juruá to Manáus, but probably throughout (5 fishes)

B. Pelvic fins present (i 4 finrays), lower gillrakers 19 or 20 (usually 20); Rio Solimões (3 fishes).

Raconda Gray, 1831

PRIST Racon

Raconda Gray, 1831, Zool.Miscellany, 1:9 (type: Raconda russeliana Gray). Apterygia Gray, 1835 (20 February), Illustr.Ind.Zool.Hardwicke, 2:pl. 92, fig. 1 (type: Apterygia ramcarate Gray, not Mystus ramcarati Hamilton-Buchanan = Coilia, an engraulidid).

Diagnostic Features: Medium-sized marine or estuarine clupeoid fishes (to perhaps not more than 20 cm standard length) with elongate and compressed bodies. No dorsal fin; no pelvic fins; anal fin longer than in any other pristigasterid genus, its base more than half standard length. The lack of a dorsal fin and the very long anal fin easily distinguish Raconda from Opisthopterus, the most similar genus in the Indo-Pacific region.

Biology, Habitat and Distribution: See species.

Interest to Fisheries: See species.

Species: A single species:

R. russeliana Gray, 1831, eastern Indian Ocean to Java Sea.

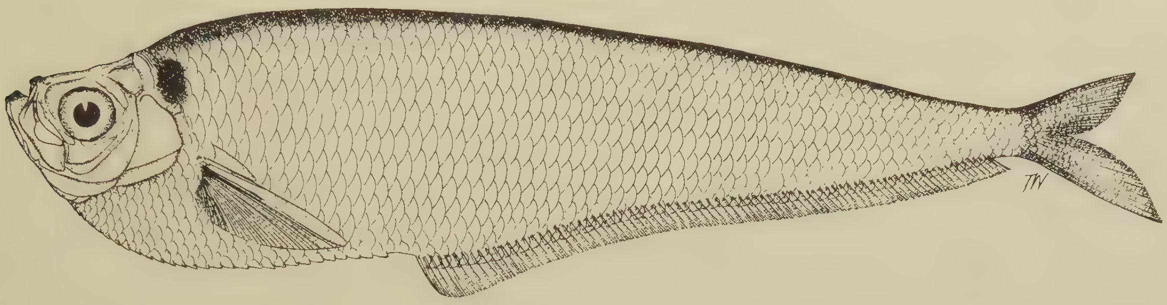
Raconda russeliana Gray, 1831

PRIST Racon 1

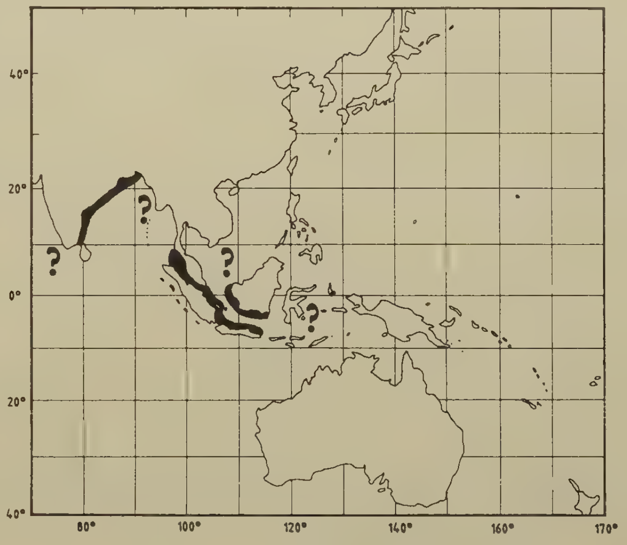
Raconda russeliana Gray, 1831, *Zool.Miscellany*, 1:9 (Sangar Roads, India).

Synonyms : *Apterygia ramcarate* Gray, 1835:pl. 92, fig. 1 (Sangar Rocks); *Apterygia hamiltoni* Valenciennes, 1847:333 (on *ramcarate*, not on *Thryssa hamiltonii* Gray = an anchovy); Fowler, 1941:665 (compiled); Whitehead, 1973b:216, fig. 4 (key, synon., refs); Wongratana, 1980:217, pls 181, 182 (revision).

FAO Names : En - Raconda.



Diagnostic Features : Body elongate, with strongly convex lower profile bearing a sharp keel of 33 to 38 scutes. Lower jaw prominent, mouth pointing obliquely upward; upper jaw short, not reaching beyond eye centre. Lower gillrakers 23 to 27. Dorsal fin absent; pelvic fins absent; anal fin very long, with 81 to 93 finrays, its origin well before midpoint of body. A dark spot behind gill opening. Most closely resembles species of *Opisthopterus*, which have a small doral fin and a slighlty shorter anal fin (51 to 65 finrays, not more than half body length). Other pristigasterids are deeper bodied, have a well developed dorsal fin and a shorter anal fin.



Geographical Distribution : Indian Ocean (eastern coasts of India, possibly also coasts of Burma), Singapore and Java Sea (south coast of Kalimantan, also Bagan Api Api, Sumatra).

Habitat and Biology : Marine, or perhaps more commonly estuarine (e.g. Aluhaluh on the Barito River, Kalimantan). Feeds mainly on prawns (especially *Acetes*), also copepods. More specimens and data needed.

Size : To 19 cm standard length.

Interest to Fisheries : Probably slight since the species seems to be uncommon in catches.

Local Names : INDIA: Raconda.

Literature : Verghese (1962 - food, fecundity, length-weight).

Remarks : Reduction of the dorsal fin occurs in other long-bodied pristigasterids (*Opisthopterus*, etc.), but only *Raconda* has lost this fin.

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